Appendix A

Glossary

GLOSSARY OF QUALITY ASSURANCE AND RELATED TERMS

Acceptance criteria — Specified limits placed on characteristics of an item, process, or service defined in requirements documents. (ASQC Definitions)

Accuracy — A measure of the closeness of an individual measurement or the average of a number of measurements to the true value.

Assessment — The evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation (PE), management systems review (MSR), peer review, inspection, or surveillance.

Audit (quality) — A systematic and independent examination to determine whether quality activities and related results comply with planned operations and whether these operations are implemented effectively and are suitable to achieve objectives.

Audit of Data Quality (ADQ) — A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Authenticate — The act of establishing an item as genuine, valid, or authoritative.

Bias — The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).

Blank — A sample subjected to the usual analytical or measurement process to establish a zero baseline or background value. Sometimes used to adjust or correct routine analytical results. A sample that is intended to contain none of the analytes of interest. A blank is used to detect contamination during sample handling preparation and/or analysis.

Calibration — A comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments.

Calibration drift — The deviation in instrument response from a reference value over a period of time before recalibration.

Certification — The process of testing and evaluation against specifications designed to document, verify, and recognize the competence of a person, organization, or other entity to perform a function or service, usually for a specified time.

Chain of custody — An unbroken trail of accountability that ensures the physical security of samples, data, and records.

Check standard — A standard prepared independently of the calibration standards and analyzed exactly like the samples. Check standard results are used to estimate analytical precision and to indicate the presence of bias due to the calibration of the analytical system.

Collocated samples — Two or more portions collected at the same point in time and space so as to be considered identical. These samples are also known as field replicates and should be identified as such.

Comparability — A measure of the confidence with which one data set or method can be compared to another.

Completeness — A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions.

Computer program — A sequence of instructions suitable for processing by a computer. Processing may include the use of an assembler, a compiler, an interpreter, or a translator to prepare the program for execution. A computer program may be stored on magnetic media and referred to as "software," or it may be stored permanently on computer chips, referred to as "firmware." Computer programs covered in a QAPP are those used for audit results, design analysis, data acquisition, data reduction, data storage (databases), operation or control, and database or document control registers when used as the controlled source of quality information.

Confidence Interval — The numerical interval constructed around a point estimate of a population parameter, combined with a probability statement (the confidence coefficient) linking it to the population's true parameter value. If the same confidence interval construction technique and assumptions are used to calculate future intervals, they will include the unknown population parameter with the same specified probability.

Conformance — An affirmative indication or judgment that a product or service has met the requirements of the relevant specification, contract, or regulation; also, the state of meeting the requirements.

Consensus standard — A standard established by a group representing a cross section of particular government agencies, industry or trade, or a part thereof.

Contractor — Any organization or individual contracting to furnish services or items or to perform work.

Corrective action — Any measures taken to rectify conditions adverse to quality and, where possible, to preclude their recurrence.

Correlation coefficient — A number between -1 and 1 that indicates the degree of linearity between two variables or sets of numbers. The closer to -1 or +1, the stronger the linear relationship between the two (i.e., the better the correlation). Values close to zero suggest no correlation between the two variables.

Data of known quality — Data that have the qualitative and quantitative components associated with their derivation documented appropriately for their intended use, and when such documentation is verifiable and defensible.

Data Quality Assessment (DQA) — The scientific and statistical evaluation of data to determine if data obtained from environmental operations are of the right type, quality, and quantity to support their intended use. The five steps of the DQA Process include: 1) reviewing the DQOs and sampling design, 2) conducting a preliminary data review, 3) selecting the statistical test, 4) verifying the assumptions of the statistical test, and 5) drawing conclusions from the data.

Data Quality Indicators (DQIs) — The quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are bias, precision, accuracy, comparability, completeness, representativeness.

Data Quality Objectives (DQOs) — The qualitative and quantitative statements derived from the DQO Process that clarify a study's technical and quality objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

Data Quality Objectives (DQO) Process — A systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use. The key elements of the DQO process include:

- state the problem,
- identify the decision,
- identify the inputs to the decision,
- define the boundaries of the study,
- develop a decision rule,
- specify tolerable limits on decision errors, and
- optimize the design for obtaining data.

DQOs are the qualitative and quantitative outputs from the DQO Process.

Data reduction — The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collating them into a more useful form. Data reduction is irreversible and generally results in a reduced data set and an associated loss of detail.

Data usability — The process of ensuring or determining whether the quality of the data produced meets the intended use of the data.

Deficiency — An unauthorized deviation from acceptable procedures or practices, or a defect in an item.

Design — The specifications, drawings, design criteria, and performance requirements. Also, the result of deliberate planning, analysis, mathematical manipulations, and design processes.

Detection Limit (DL) — A measure of the capability of an analytical method to distinguish samples that do not contain a specific analyte from samples that contain low concentrations of the analyte; the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability. DLs are analyte- and matrix-specific and may be laboratory-dependent.

Distribution — 1) The appointment of an environmental contaminant at a point over time, over an area, or within a volume; 2) a probability function (density function, mass function, or distribution function) used to describe a set of observations (statistical sample) or a population from which the observations are generated.

Document — Any written or pictorial information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results.

Document control — The policies and procedures used by an organization to ensure that its documents and their revisions are proposed, reviewed, approved for release, inventoried, distributed, archived, stored, and retrieved in accordance with the organization's requirements.

Duplicate samples — Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method, including sampling and analysis. See also *collocated sample*.

Environmental conditions — The description of a physical medium (e.g., air, water, soil, sediment) or a biological system expressed in terms of its physical, chemical, radiological, or biological characteristics.

Environmental data — Any parameters or pieces of information collected or produced from measurements, analyses, or models of environmental processes, conditions, and effects of pollutants on human health and the ecology, including results from laboratory analyses or from experimental systems representing such processes and conditions.

Environmental monitoring — The process of measuring or collecting environmental data.

Environmental processes — Any manufactured or natural processes that produce discharges to, or that impact, the ambient environment.

Environmental programs — An all-inclusive term pertaining to any work or activities involving the environment, including but not limited to: characterization of environmental processes and conditions; environmental monitoring; environmental research and development; the design, construction, and operation of environmental technologies; and laboratory operations on environmental samples.

Environmental technology — An all-inclusive term used to describe pollution control devices and systems, waste treatment processes and storage facilities, and site remediation technologies and their components that may be utilized to remove pollutants or contaminants from, or to prevent them from entering, the environment. Examples include wet scrubbers (air), soil washing (soil), granulated activated carbon unit (water), and filtration (air, water). Usually, this term applies to hardware-based systems; however, it can also apply to methods or techniques used for pollution prevention, pollutant reduction, or containment of contamination to prevent further movement of the contaminants, such as capping, solidification or vitrification, and biological treatment.

Estimate — A characteristic from the sample from which inferences on parameters can be made.

Field blank — A blank used to provide information about contaminants that may be introduced during sample collection, storage, and transport. A clean sample, carried to the sampling site,

exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample.
Financial assistance — The process by which funds are provided by one organization (usually governmental) to another organization for the purpose of performing work or furnishing services or items. Financial assistance mechanisms include grants, cooperative agreements, and governmental interagency agreements.

Finding — An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive or negative, and is normally accompanied by specific examples of the observed condition.

Goodness-of-fit test — The application of the chi square distribution in comparing the frequency distribution of a statistic observed in a sample with the expected frequency distribution based on some theoretical model.

Guidance — A suggested practice that is not mandatory, intended as an aid or example in complying with a standard or requirement.

Guideline — A suggested practice that is not mandatory in programs intended to comply with a standard.

Holding time — The period of time a sample may be stored prior to its required analysis.

Identification error — The misidentification of an analyte. In this error type, the contaminant of concern is unidentified and the measured concentration is incorrectly assigned to another contaminant.

Independent assessment — An assessment performed by a qualified individual, group, or organization that is not a part of the organization directly performing and accountable for the work being assessed.

Inspection — The examination or measurement of an item or activity to verify conformance to specific requirements.

Internal standard — A standard added to a test portion of a sample in a known amount and carried through the entire determination procedure as a reference for calibrating and controlling the precision and bias of the applied analytical method.

Laboratory split samples — Two or more representative portions taken from the same sample and analyzed by different laboratories to estimate the interlaboratory precision or variability and the data comparability.

Limit of quantitation — The minimum concentration of an analyte or category of analytes in a specific matrix that can be identified and quantified above the method detection limit and within specified limits of precision and bias during routine analytical operating conditions.

Management — Those individuals directly responsible and accountable for planning, implementing, and assessing work.

Management system — A structured, nontechnical system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for conducting work and producing items and services.

Management Systems Review (MSR) — The qualitative assessment of a data collection operation and/or organization(s) to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate for ensuring that the type and quality of data needed are obtained.

Matrix spike — A sample prepared by adding a known mass of a target analyte to a specified amount of matrix sample for which an independent estimate of the target analyte concentration is available. Spiked samples are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

May — When used in a sentence, a term denoting permission but not a necessity.

Mean (arithmetic) — The sum of all the values of a set of measurements divided by the number of values in the set; a measure of central tendency.

Mean squared error — A statistical term for variance added to the square of the bias.

Measurement and Testing Equipment (M&TE) — Tools, gauges, instruments, sampling devices, or systems used to calibrate, measure, test, or inspect in order to control or acquire data to verify conformance to specified requirements.

Memory effects error — The effect that a relatively high concentration sample has on the measurement of a lower concentration sample of the same analyte when the higher concentration sample precedes the lower concentration sample in the same analytical instrument.

Method — A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

Method blank — A blank prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of method blanks provide an estimate of the within-batch variability of the blank response and an indication of bias introduced by the analytical procedure.

Mid-range check — A standard used to establish whether the middle of a measurement method's calibrated range is still within specifications.

Must — When used in a sentence, a term denoting a requirement that has to be met.

Nonconformance — A deficiency in a characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate; nonfulfillment of a specified requirement.

Objective evidence — Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measurements, or tests that can be verified.

Observation — An assessment conclusion that identifies a condition (either positive or negative) that does not represent a significant impact on an item or activity. An observation may identify a condition that has not yet caused a degradation of quality.

Organization — A company, corporation, firm, enterprise, or institution, or part thereof, whether incorporated or not, public or private, that has its own functions and administration.

Organization structure — The responsibilities, authorities, and relationships, arranged in a pattern, through which an organization performs its functions.

Outlier — An extreme observation that is shown to have a low probability of belonging to a specified data population.

Parameter — A quantity, usually unknown, such as a mean or a standard deviation characterizing a population. Commonly misused for "variable," "characteristic," or "property."

Peer review — A documented critical review of work generally beyond the state of the art or characterized by the existence of potential uncertainty. Conducted by qualified individuals (or an organization) who are independent of those who performed the work but collectively equivalent in technical expertise (i.e., peers) to those who performed the original work. Peer reviews are conducted to ensure that activities are technically adequate, competently performed, properly documented, and satisfy established technical and quality requirements. An in-depth assessment of the assumptions, calculations, extrapolations, alternate interpretations, methodology, acceptance criteria, and conclusions pertaining to specific work and of the documentation that supports them. Peer reviews provide an evaluation of a subject where quantitative methods of analysis or measures of success are unavailable or undefined, such as in research and development.

Performance Evaluation (PE) — A type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory.

Pollution prevention — An organized, comprehensive effort to systematically reduce or eliminate pollutants or contaminants prior to their generation or their release or discharge into the environment.

Population — The totality of items or units of material under consideration or study.

Precision — A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions expressed generally in terms of the standard deviation.

Procedure — A specified way to perform an activity.

Process — A set of interrelated resources and activities that transforms inputs into outputs. Examples of processes include analysis, design, data collection, operation, fabrication, and calculation.

Project — An organized set of activities within a program.

Qualified data — Any data that have been modified or adjusted as part of statistical or mathematical evaluation, data validation, or data verification operations.

Qualified services — An indication that suppliers providing services have been evaluated and determined to meet the technical and quality requirements of the client as provided by approved procurement documents and demonstrated by the supplier to the client's satisfaction.

Quality — The totality of features and characteristics of a product or service that bears on its ability to meet the stated or implied needs and expectations of the user.

Quality Assurance (QA) — An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

Quality Assurance Program Description/Plan — See *quality management plan*.

Quality Assurance Project Plan (QAPP) — A formal document describing in comprehensive detail the necessary quality assurance (QA), quality control (QC), and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. The QAPP components are divided into four classes: 1) Project Management, 2) Measurement/Data Acquisition, 3) Assessment/Oversight, and 4) Data Validation and Usability. Guidance and requirements on preparation of QAPPs can be found in EPA QA/R-5 and QA/G-5.

Quality Control (QC) — The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality. The system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring the results are of acceptable quality.

Quality control (QC) sample — An uncontaminated sample matrix spiked with known amounts of analytes from a source independent of the calibration standards. Generally used to establish intra- laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system.

Quality improvement — A management program for improving the quality of operations. Such management programs generally entail a formal mechanism for encouraging worker recommendations with timely management evaluation and feedback or implementation.

Quality management — That aspect of the overall management system of the organization that determines and implements the quality policy. Quality management includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, and assessment) pertaining to the quality system.

Quality Management Plan (QMP) — A formal document that describes the quality system in terms of the organization's structure, the functional responsibilities of management and staff, the lines of authority, and the required interfaces for those planning, implementing, and assessing all activities conducted.

Quality system — A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products, and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC).

Readiness review — A systematic, documented review of the readiness for the start-up or continued use of a facility, process, or activity. Readiness reviews are typically conducted before proceeding beyond project milestones and prior to initiation of a major phase of work.

Record (quality) — A document that furnishes objective evidence of the quality of items or activities and that has been verified and authenticated as technically complete and correct. Records may include photographs, drawings, magnetic tape, and other data recording media.

Recovery — The act of determining whether or not the methodology measures all of the analyte contained in a sample.

Repeatability — The degree of agreement between independent test results produced by the same analyst, using the same test method and equipment on random aliquots of the same sample within a short time period.

Reporting limit — The lowest concentration or amount of the target analyte required to be reported from a data collection project. Reporting limits are generally greater than detection limits and are usually not associated with a probability level.

Representativeness — A measure of the degree to which data accurately and precisely represent a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition.

Reproducibility — The precision, usually expressed as variance, that measures the variability among the results of measurements of the same sample at different laboratories.

Requirement — A formal statement of a need and the expected manner in which it is to be met.

Research (applied) — A process, the objective of which is to gain the knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

Research (basic) — A process, the objective of which is to gain fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.

Research development/demonstration — The systematic use of the knowledge and understanding gained from research and directed toward the production of useful materials, devices, systems, or methods, including prototypes and processes.

Round-robin study — A method validation study involving a predetermined number of laboratories or analysts, all analyzing the same sample(s) by the same method. In a round-robin study, all results are compared and used to develop summary statistics such as interlaboratory precision and method bias or recovery efficiency.

Ruggedness study — The carefully ordered testing of an analytical method while making slight variations in test conditions (as might be expected in routine use) to determine how such variations affect test results. If a variation affects the results significantly, the method restrictions are tightened to minimize this variability.

Scientific method — The principles and processes regarded as necessary for scientific investigation, including rules for concept or hypothesis formulation, conduct of experiments, and validation of hypotheses by analysis of observations.

Self-assessment — The assessments of work conducted by individuals, groups, or organizations directly responsible for overseeing and/or performing the work.

Sensitivity — the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest.

Service — The result generated by activities at the interface between the supplier and the customer, and the supplier internal activities to meet customer needs. Such activities in environmental programs include design, inspection, laboratory and/or field analysis, repair, installation, and calibration.

Shall — A term denoting a requirement that is mandatory whenever the criterion for conformance with the specification permits no deviation. This term does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

Should — A term denoting a guideline or recommendation whenever noncompliance with the specification is permissible.

Significant condition — Any state, status, incident, or situation of an environmental process or condition, or environmental technology in which the work being performed will be adversely affected sufficiently to require corrective action to satisfy quality objectives or specifications and safety requirements.

Software life cycle — The period of time that starts when a software product is conceived and ends when the software product is no longer available for routine use. The software life cycle typically includes a requirement phase, a design phase, an implementation phase, a test phase, an installation and check-out phase, an operation and maintenance phase, and sometimes a retirement phase.

Span check — A standard used to establish that a measurement method is not deviating from its calibrated range.

Specification — A document stating requirements and referring to or including drawings or other relevant documents. Specifications should indicate the means and criteria for determining conformance.

Spike — A substance that is added to an environmental sample to increase the concentration of target analytes by known amounts; used to assess measurement accuracy (spike recovery). Spike duplicates are used to assess measurement precision.

Split samples — Two or more representative portions taken from one sample in the field or in the laboratory and analyzed by different analysts or laboratories. Split samples are quality control (QC) samples that are used to assess analytical variability and comparability.

Standard deviation — A measure of the dispersion or imprecision of a sample or population distribution expressed as the positive square root of the variance and has the same unit of measurement as the mean.

Standard Operating Procedure (SOP) — A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and that is officially approved as the method for performing certain routine or repetitive tasks.

Supplier — Any individual or organization furnishing items or services or performing work according to a procurement document or a financial assistance agreement. An all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, or consultant.

Surrogate spike or analyte — A pure substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them to establish that the analytical method has been performed properly.

Surveillance (quality) — Continual or frequent monitoring and verification of the status of an entity and the analysis of records to ensure that specified requirements are being fulfilled.

GREAT BASIN UNIFIED
AIR POLLUTION CONTROL DISTRICT

AIR MONITORING QUALITY ASSURANCE

PM 10 QAPP

APPENDIX B

STANDARD OPERATING PROCEDURES

FOR

MASS ANALYSIS OF FINE PARTICULATE COLLECTED ON TEFLON FILTERS

JANUARY 2013

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

STANDARD OPERATING PROCEDURE FOR MASS ANALYSIS OF FINE PARTICULATE COLLECTED ON TEFLON FILTERS

1.0 SCOPE

This document describes the methodology used by the laboratory staff to analyze the mass of fine particulate matter (PM2.5) samples collected on Teflon filters.

2.0 SUMMARY OF METHOD

Individual Teflon filters (46.2 mm in diameter) are weighed on an electronic microbalance before and after field sampling. Particulate matter less than 2.5 µm in aerodynamic diameter is collected from ambient air over a 24-hour period on
one of these filters. The net difference between pre- and post-sampling filter weights is used to calculate the ambient air mass concentration. After final weighing, filters are stored for subsequent analysis.

3.0 INTERFERENCES

3.1 The potential effect of body moisture or oils contacting the filters is minimized by using non-serrated forceps to handle the filters at all times. This measure also moderates interference due to static electricity.

3.2 Teflon filters accumulate a surface electrical charge which may affect filter weight. Static electricity is controlled by treating filters on a "Static Master" static charge neutralizer prior to weighing. Holding filters between two "Static Masters" is required for a minimum of twenty seconds before any filter can be weighed.

3.3 Moisture content can affect filter weight. Filters must be equilibrated for a minimum of 24 hours in a controlled environment prior to pre- and postweighing. During the equilibration period, relative humidity must be maintained at a mean value of 32.5-37.5% and air temperature at a mean of 21-23 degrees Celsius.

3.4 Airborne particulates can adversely affect an accurate mass measurement of the filter. Equilibrating filters should not be placed within airflow paths created by air conditioning ductwork, near computer printers or turbulence created by opening and closing doors. Dust contamination can be further minimized by cleaning the lab bench tops and weighing areas daily, installing "sticky" floor mats at the entrance to the balance room, and wearing clean lab coats over regular clothing.

4.0 APPARATUS

4.1 Sartorius M5P electronic microbalance with a minimum resolution of 0.001 mg (i.e., 1 microgram) and a precision of $\pm$ 0.001 mg, supplied with a balance pan. The microbalance must be positioned upon a marble balance support table.

4.2 Calibration weights, utilized as Mass Reference Standards, should be non-corroding, range in weight from 100 mg to 200 mg and be certified as traceable to National Institute of Standards and Testing (NIST) mass standards. Two sets are needed, one set as a working standard and one set as the primary standard. The weights should be Class 1 category with a tolerance of 0.01mg.

4.3 Radioactive (alpha-particle) Polonium-210 ("StaticMaster") antistatic strips for charge neutralization. At least 2 strips are needed per balance.

4.4 Non-serrated forceps.

4.5 Digital timer/stopwatch or analog clock.

4.6 Filter: Teflon membrane, 46.2 mm in diameter with a polymethylpentene support ring.

4.7 Filter support cassettes.

4.8 Filter equilibration racks.

4.9 Dickson relative humidity/temperature recorder.

4.10 Psychrometer (NIST certified) for calibration of relative humidity readings.

4.11 Humidity calbration kit with three salt solutions: LiCl, $MgCl_2$, NaCl for humidity checks at 11%, 33%, and 75%

4.11 Precision thermometer (NIST certified) for calibration of temperature readings.

4.12 Light box.

4.13 Antistatic, nitrate-free, phosphate-free, sulfate-free, lint-free 100% nylon gloves.

4.14 Plastic petri-slide filter containers.

4.15 Zip-lock plastic bags, 5"x8".

4.16 Disposable laboratory wipes.

4.17 Filter equilibration cabinet(s).

4.18 Metal shipping containers and fiberglass filter cassette magazine(s) (supplied with R & P and Thermo FRM sequential samplers), metal shipping containers for individual filters (supplied by BGI and other manufacturers for single-filter samplers).

5.0 BALANCE CALIBRATION PROCEDURE

5.1 Prior to any filter weighing, the balance must be calibrated. First, check the balance level and adjust as needed. After connecting the balance to a line source, the liquid crystal display should read "stand-by". Press the on/off key to activate the balance. The balance performs an internal circuitry check which is complete when "CH2" appears in the liquid crystal display (LCD). The LCD then displays an "L", indicating that the internal load weights should be removed (The internal load weights are used only for weighing objects in excess of 1500 or 3000 mg). Press the bottom white key marked with the small white "T" to remove the load weights. The LCD should soon display "0.000" and a stabilization bubble (which appears as a small "o" in the upper right corner of the display). Open the weighing chamber door to allow equilibration to room temperature. To ensure maximum stability, the microbalance must remain on at all times; the display will register "stand-by" when not in use.

5.2 Internal Calibration: After chamber equilibration (usually one minute), close the cover. Once the stabilization bubble in the LCD (hereafter referred to as the "bubble") appears above the "mg", press the "CAL" key. The LCD should soon display "0.000" and the bubble and the "CAL" LED will be illuminated. Press the "CAL" key a second time and the LCD will display a "C" followed by "CC" and then followed by "0.000" and the bubble and "CAL" LED goes out. The balance is now ready for an external calibration check. However, should the display read "CE", an error has occurred and the calibration must be repeated as described above.

5.3 External Calibration Check: Open the chamber door. Place a 100 mg working reference standard calibration weight onto the balance pan with nonmetallic forceps. Close the chamber door and record the date, temperature and relative humidity in a quality control notebook assigned to the microbalance on which the weighing procedure is being performed. After the LCD displays a weight readout and the bubble, wait for 30-45 seconds then record the weight readout in the quality control logbook along with temperature and humidity data and initial. Remove the calibration weight and tare the balance by tapping the red "T" key to re-register a balance zero reading. Repeat this same procedure with a 200 mg calibration weight. The balance is now ready for weighing the filters. The weight readouts of calibration and filter masses must be documented on the quality control logsheets. External calibration will be performed daily for each day that filters are pre- and/or postweighed.

6.0 FILTER INSPECTION AND EQUILIBRATION

6.1 When the filters initially are brought into the laboratory for preconditioning and preweighing, they should be transferred from their sealed manufacturer's packaging to a filter-handling container such as a glass or plastic petri dish. The filters should be handled only with non-serrated forceps. Vinyl or 100% nylon gloves that are lint-free, ion-free, powder-free and antistatic may be worn by lab personnel when filters are being prepared for conditioning and weighing. These precautions reduce the risk of body moisture or oils coming into contact with the filters and affecting mass measurements. Before the filter is placed in a container, it has to be inspected for defects. This is done by examining a filter on a "light table" or over a dark surface (lab bench top). A filter must be discarded if any defects are found. Specific defects to look for are the following:

1. **Pinhole**--A small hole appearing (a) as a distinct and obvious bright point of light when examined over a light table or screen or (b) as a dark spot when viewed over a dark surface.

2. **Separation of ring--**Any separation or lack of seal between the filter and the filter border reinforcing the ring.

3. **Chaff or flashing**--Any extra material on the reinforcing, polymethylpentene ring or on the heat seal area that would prevent an airtight seal during sampling.

4. **Loose material--**Any extra loose material or dirt particles on the filter.

5. **Discoloration**--Any obvious discoloration tat might be evidence of contamination.

6. **Filter nonuniformity--**Any obvious visible nonuniformity in the appearance of the filter when viewed over a light table or a black surface that might indicate gradations in porosity or density across the face of the filter.

7. **Other--**A filter with any imperfection not described above, such as irregular surfaces or other results of poor workmanship.

6.2 After inspection, filters must be conditioned within an environmentally controlled room for at least 24 hours prior to performing presampling weighing (preweighing). Mean relative humidity must be held to 32.5-

37.5% and the mean temperature must be held to 21-23 degrees Celsius. Once per quarter, the hygrothermograph recorder is checked against the laboratory humidity sensor. Once per month the laboratory humidity sensor (Vaisala HMP35C) is calibrated at three points using the salt solutions described above. The relative humidity recording is checked against an NIST- certified psychrometer and the temperature recording is checked against an NIST- certified thermometer twice per year.

6.3 From each new lot of filters received, take a random sample of 3 filters as "lot blanks" and expose each in a separate container within the controlled room environment. Weigh these "lot blanks" every 24 hours (as explained in Sections 7.6 and 7.7). The filters should be conditioned in an open-sided cabinet that will allow air circulation over the filters while reducing the chance that extraneous airborne material inside the conditioning room will settle onto the filters. If the weight change after 24 hours exceeds 15 micrograms, continue conditioning until the 24-hour weight variation is less than 15 micrograms for each of the 3 "lot blanks". This process should take less than a week. Inscribe information concerning the lot number, balance ID number, and dates of "lot blank" weighings on the <u>Lot Blank Filter Conditioning Mass Data Form</u>. Once the "lot blanks" have generated stable mass values, note the time taken from initial exposure of the filters to balance room conditions until achievement of stable mass. This period is designated as the minimum time needed to condition other filters from the same lot before they can be preweighed and used for routine sampling.

6.4 After the minimum conditioning period has been determined, select a number of filters that can be satisfactorily weighed with an acceptable level of precision within the normal working day (20-40 filters should be an adequate number). Condition the selected filters for at least the time required and set aside for preweighing.

7.0 <u>PRESAMPLING FILTER WEIGHING</u>

7.1 Record the relative humidity and temperature of the conditioning environment in the quality control logbook for the balance. Ensure that 1) the temperature and the relative humidity of the Balance Room have remained (and are currently) within the allowable limits (see Section 3.0) throughout the previous 24 hours and that 2) the selected filters have been conditioned for at least the minimum time needed to attain mass stability, as determined from the lot blanks.

7.2 Clean the microbalance's weighing chamber with a fine brush, if necessary. Clean the surfaces near the microbalance with antistatic solution or methyl alcohol-moistened disposable laboratory wipes. Clean the forceps used for handling the mass reference weights and the filters with the moistened wipes prior to each weighing session. Ensure that both forceps are thoroughly dry.

7.3 Perform an internal and external calibration of the microbalance (as described in Section 5.0) prior to beginning each daily weighing session. Once the weighing procedure begins however, you only need to tare (i.e., zero) the microbalance before weighing each consecutive filter.

7.4 Obtain the appropriate shipping container(s) designated for use with the sampler at the monitoring site for which filters are to be preweighed, and appropriate filter support cassettes and metal covers or filter cassette magazine, etc. For filters being sent to monitoring sites using R&P samplers use blue polypropylene cassettes with a beveled inner edge on the top ring; for filters being sent to monitoring sites using BGI samplers use white Delrin cassettes without the beveled top ring.

7.5 Boot up the computer, open EXCEL and the appropriate spreadsheet for the filters to be weighed. Enter the site, filter number and initial weight or final weight in the appropriate cells. The initial weight or final weight will transfer to the appropriate cell electronically by pressing the white "print" key on the balance, marked with a circle with a dot in the middle and line underneath the circle.

7.6 Take each conditioned filter, using forceps and gripping the filter only by the outer polymethylpentene support ring, and hold the filter (support ring side up) between the two static neutralizers. Hold the filter between the static neutralizers for a minimum of 20 seconds prior to weighing.

7.7 Place the filter onto the balance pan and close the cover. Each filter is assigned a **24-Hour Sample Report-Field Data Sheet** (24-Hour Sample Report) that includes the **chain of custody record** and will be used for recording information about the filter sample. After approximately 10 seconds, the bubble will appear over the "mg" on the balance display. Wait an additional 10 seconds after the bubble appears to ensure the balance has stabilized. Record the weight on the hardcopy filter weight form in pen, and press the balance "print" button to electronically record the weight in the computer spreadsheet. Record this mass as a "preweight" value on the 24-Hour Sample Report. Date and initial the 24-Hour Sample Report and enter a date on the "Postweigh by" line that is 30 days from the preweighing date. NOTE: "Postweigh by" dates are only necessary for PM2.5 filter samples.

7.8 After the weight is entered in the spreadsheet and recorded on the sample report form, you are ready to begin weighing the next filter. If there is a need to re-weigh a filter, however, enter the data in a separate column in the spreadsheet for the reweigh data.

7.9 After the filter is weighed secured it in an appropriate (see Section 7.4) filter support cassette, with the filter's support ring facing up.

7.9.1 <u>BGI Samplers</u>: Fasten the protective metal covers onto the cassette. Label the cassette with the filter ID number and place it in the metal filter-shipping cylinder used for transfer to the sampling site.

7.9.2 <u>R & P and Thermo Single Filter Samplers</u>: Place filter cassette in an individual metal shipping container. The metal shipping container should be labelled with the filter ID number.

7.9.3 <u>R & P and Thermo Sequential Filter Samplers</u>: Place filter cassette(s) in a fiberglass filter cassette magazine. Cap the ends of the magazine with the Cap Plugs provided by the manufacturer. Place the loaded magazine into the metal shipping container.

7.9.4 Each filter comes with a unique preprinted number on the support ring. This number must be recorded on the 24-Hour Sample Report as the filter ID Number. Each filter cassette is uniquely numbered as well. The filter cassette ID number must also be recorded on the 24-Hour Sample Report.

7.10 After each filter is weighed, if the microbalance does not return to zero, the microbalance can be zeroed by pressing the red **TARE** key. After it is zeroed, the balance is ready for the next filter.

7.11 After repeating the above steps for 9 individual filters, a field blank should be weighed. Select any conditioned filter and weigh as described above, but select a filter number preceded by the designation **FB** and record this number on the 24-Hour Sample Report. Once this weighing has been completed, recheck the balance by weighing a standard mass. The microbalance is tared and either a 100 mg or a 200 mg mass working reference standard is weighed as a QC check.
NOTE: Each working standard will be checked against the corresponding laboratory primary standard mass at least monthly. If the standards disagree by more than 3 micrograms, the working standards must be checked by a certified outside contractor and replaced if necessary.

7.12 A duplicate filter must be selected from the previous 9 routine sample filters and weighed as a quality control check. Weigh the filter, as described above, record the weight on the 24-Hour Report as a duplicate mass, and enter it in the spreadsheet. If the duplicate mass varies more than 15 micrograms from the original mass measurement, tare the microbalance and reweigh the filter. If the variation in mass remains more than 15 micrograms, flag the filter in question and consult with the laboratory supervisor.

7.13 Affix to each filter’s 24-Hour Sample Report sheet a filter bar code label corresponding to the filter ID number, and record the site name. The site operator will add the AIRS site number and other relevant information needed to characterize a specific filter sampled at a specified site. When the preweighed filters are loaded into the sampler, the **chain of custody** portion of the 24-Hour Sample Report will be signed by the field operator and the date and time recorded.

7.14 Stack together all 24-Hour Sample Reports for filters in one filter-shipping cylinder or magazine going to one site, folded so that the site name is readable. Place these in a 5"x8" zip-lock bag and wrap this around the shipping cylinder or magazine, securing in place with a rubber band. In the case of the single-filter samplers, place each individual filter shipping container with the corresponding 24-Hour Sample Report into an 11"x 13" or larger zip-lock bag.

7.15 During the first preweighing session, and as needed during later weighing sessions (consult with the laboratory supervisor), designate four filters to be used as **lab blanks**. Assign a unique identification number LBxxxx to each of four filters and record this on the petri-slide label and in the laboratory QC notebook. Weigh as indicated in Sections 7.6 and 7.7, and additionally record, along with the date, the information in the QC notebook. Initial each weight entry. Replace the filters in their petri-slides and leave open in the cabinet where sample filters are conditioned.

8.0 POSTSAMPLING TRACKING, DOCUMENTATION & INSPECTION

8.1 Upon receipt of filter samples from the field, the laboratory technician will perform the following steps:

1. Remove the attached bag of 24-Hour Sample Reports.
2. On each 24-Hour Sample Report, in the "received by lab" column on the **chain of custody record**, note date and time at the time of sample arrival in the lab.
3. Inspect the condition of the sample container and filter samples, especially for contamination by moisture during shipping.
4. Keep the 24-Hour Sample Reports with the shipping cylinder, magazine, or single filter shipping containers.
5. The shipping container will be placed in the lab until ready for conditioning.

8.2 The Laboratory Technician will verify acceptance of the filters for postweighing by examining the 24-Hour Sample Report (which includes the **chain of custody**). If field data are missing or not obtainable from the site operator or if a sampler malfunction is evident, "flag" the filter on its 24-Hour Sample Report Sheet and continue processing the next filter. A "flagged" filter is archived and stored in the lab until further consultation with a lab supervisor determines whether the filter is acceptable or declared invalid.

8.3 When ready to start conditioning of the filters move the shipping cylinder to the gravimetric laboratory. Remove each filter cassette from the shipping container and remove its protective metal covers (if applicable), but keep the filter in its filter support cassette for handling. Use a "light table" to check on the physical appearance of the filter sample area (especially for pinholes). If particulate matter is found on the inside of the metal covers or on the inside of the single-filter transport container after the filter has been removed, note that observation on the 24-Hour Sample Report and "flag" the filter. Consult the lab supervisor to determine whether the filter should be invalidated.

8.4 Remove the filter from the support cassette using the filter cassette separator. Match the filter with the appropriate 24-Hour Sample Report, and with a petri-slide labeled with a barcode number identical to the filter ID number. Antistatic, ion-free, lint-free 100% nylon or vinyl gloves may be worn during filter handling. Inspect the filter for any damage that may have occurred during sampling that was not revealed during the initial inspection. If any damage is found, "flag" the filter and record this on the 24-Hour Sample Report and hold the filter for further consultation by the lab supervisor. If the filter is found to be acceptable for mass analysis, transfer it into the petri-slide and place the cover on loosely.

8.5 After the filters have been inspected and processed as described above, log in each individual filter by transmitting the bar-code filter ID number on the 24-Hour Sample Report provided into the appropriate District spreadsheet. Write the ID number generated from the database onto the 24-Hour Sample Report, the petri-slide label and in a laboratory logbook. Place each filter (in its petri-slide, with the cover underneath or fitted loosely to allow free circulation of air over the filter) onto the filter equilibration rack and place in a well-ventilated cabinet in the gravimetric laboratory. Allow the filters to equilibrate for at least 24 hours. It should be noted that the relative humidity conditions for post-sampling filter mass weighing after conditioning should be within $\pm$ 5% of the presampling conditioning environment.

9.0 POSTSAMPLING FILTER WEIGHING

9.1 After conditioning, remove the racks containing the postsampling filters from the cabinets and retrieve the 24-Hour Sample Reports. Match up the filter ID numbers on the petri slides and on the 24-Hour Sample Reports and place them on the bench top near the microbalance. Place filters in an orderly fashion on the balance table adjacent to the microbalance.

9.2 Calibrate the microbalance as described in Sections 5.1, 5.2, and 5.3. After calibration, at the start of each weighing session re-weigh the four **lab blank** filters. These are filters that have been conditioned, weighed, then left continually exposed in the cabinets where sample filters are conditioned (see

Section 7.15). Record the weight of the lab blanks, and the date, in the QC notebook and initial the record. The average weight change for these filters should not exceed 15 micrograms per day of exposure. If this limit is exceeded consult with the laboratory supervisor before weighing any sample filters. Long-term results can also be used to measure the mass stability of the Teflon filters over time.

9.3 Open the appropriate spreadsheet and find the rows containing the preweight information for the filters that have now been exposed. The post-sampling or exposed filter data will be entered in the appropriate columns in the same spreadsheet as the initial or unexposed filter data were entered.

9.4 Begin weighing as described in Sections 7.6 and 7.7, except that when the mass read-out appears on the LCD screen record the value on the 24-Hour Sample Report in the "postweight" space. Then enter the data on the hardcopy filter weight form in pen, and electronically by pressing the "print" button on the balance to transfer the weight to the appropriate spreadsheet, and proceed with the next sample. After 9 individual filters have been weighed, which may include field blank filters, it may be necessary to weigh a **check standard** and then reweigh a sample filter. The filter number of the reweighed filter will be the same as the original filter, except for the inclusion of a notation of the duplicate weight in the comments column of the spreadsheet. Record the duplicate weight on the 24-Hour Sample Report and the hardcopy filter weight form. Also record the date of postweighing on the 24-Hour Sample Report and on the hardcopy filter weight form.

9.5 If mass difference between the preweight and postweight of a "field blank" filter is greater than 60 micrograms, "flag" that filter and notify the site operator and the lab supervisor. If mass differences between the original and replicate mass read-outs from a postweighed duplicate are greater than 20 micrograms, flag that filter and notify the lab supervisor.

9.6 If, after postweighing, the filter will receive further analysis, return it to the conditioning container, close the container tightly and note on the conditioning container that additional analyses are required. Transfer the filter, along with any special comments on a copy of the 24-Hour Sample Report, to the lab responsible for performing additional analyses.

Appendix C

Particulate Matter Data Qualifiers/ Flags

A sample qualifier or a result qualifier is an indicator of the fact and the reason that the subject analysis

(a) did not produce a numeric result,

(b) produced a numeric result but it is qualified in some respect relating to the type or validity of the result, or

(c) produced a numeric result but for administrative reasons is not to be reported outside the laboratory.

An alphanumeric code is used for invalid data. An alphabetic code represents a data flag indicating the data is qualified in some respect and may be invalidated.

Table C-1 Field Qualifiers

Code	Definition	Description
CNTM	Contamination	Contamination including observations of insects or other debris
DMG	Filter Damage	Filter appeared damaged
Tm	Elapsed Sample Time	Elapsed sample time <23 hours or >25 hours
See Table C-3	Event	Exceptional event expected to have affected sample (dust, fire , spraying etc)
OFU	Operator Foul-up	An occurrence in the field that may have damaged the sample.
FlV	Flow Variation	Flow rate 5 min avg out of specification
FTp	Filter Temperature	Filter temperature differential >5°C from ambient over 30 minute interval
PF	Power Failure	Power failure >1 min. duration during sample run
FCF	Failed Single Point Calibration Verification	Failed the initial single point calibration verification
Flo	Flow rate out of spec.	Flow rate >10% deviation from setpoint for > 60 seconds
SDam	Sampler Damaged	Sampler appears to be damaged which may have affected filter

Table C-2 Laboratory Qualifiers

Code	Definition	Description
LFU	Laboratory Foul-up	An occurrence in the laboratory that may have affected the sample.
INV	Invalid	Indicates sample was invalidated.

Table C-3 List of Events for PM10 Mass Concentrations

Field Code	AQS Code	Description
A	IJ	High Winds
C	IS	Volcanic eruptions
D	?	Sandblasting
E	IT	Forest fire/Wildfire
F	IP	Structural fire
G	II	High pollen count
H	IC	Chemical spills and industrial accidents
J	IE	Construction/demolition
K	?	Agricultural tilling
L	?	Highway construction
N	?	Sanding/salting of streets
O	IK	Infrequent large gatherings
P	?	Roofing operations
Q	IM	Prescribed burning
R	ID	Clean up after a major disaster
S	IN	Seismic activity

Table C-4 AIRS Data Validation Codes

W	Sample flow rate out of limits
X	Filter Temp. Differential 30-min. Interval out of specification
Y	Sample Period out of specification
?	Multiple Flags

Appendix D
Job Descriptions

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

Air Pollution Control Officer/Executive Officer

Definition
Under policy direction of the Regional Governing Board of the District, the Air Pollution Control Officer plans, organizes, coordinates and directs through management and supervisory staff, all District functions and activities. As the Chief Executive Officer, the incumbent provides policy guidance, development and strategy recommendations regarding air quality management to the Governing Board or legislative body of the District; and fosters cooperative working relationships with the Governing Board and Hearing Board or quasi-judicial body of the District. Promotes positive, effective responsive working relationships with District staff, industry representatives, the public and other agencies. Assesses District needs and assures adequate legal, financial. Political and technical resources are available to attain and maintain State and Federal ambient air quality standards in the counties of alpine, Mono and Inyo. Carries out the duties required by law, especially Sections 40752 and 40753 of the California Health and Safety code. Performs other related duties as required.

Distinguishing Characteristics
This position has overall responsibility for policy development, administration, financial management, enforcement, permit, technical, planning and public information functions of the District. The incumbent is responsible for accomplishing all District goals and objectives in an effective and efficient manner. This includes challenges unique to this District and position, such as the air pollution issues at Owens and Mono Lakes and the large, sparsely populated nature of the District.

Examples of Principle Duties
(The following is used as a partial description and is not restrictive to duties required)

Plans, organizes, coordinates and directs all functions and activities of the District through subordinate management and supervisory staff. Oversees all administrative activities including formulation and administration of a comprehensive annual budget for the District; monitors and controls District expenditures; develops and implements management systems, procedures, and application of standards for program evaluation on a District-wide basis; and maintains complete accurate records;

Directs District recruitment, interviewing, selection, hiring decisions, performance evaluation process, and all disciplinary actions. Provides timely updates to the Governing Board regarding potential organization changes, staffing changes and their related budget implications. Reviews and authorizes personnel actions. Directs and participates in research projects; participates in the design of testing protocol and interpretation of results; directs CEQA work. Oversees preparation of board agendas, packets, and required official public notices.

Directs development of comprehensive air quality management plans and updates as required; ensures implementation and enforcement of regulations and guidelines contained within such plans. Directs and participates in the development and implementation of District goals, objectives, policies, procedures and work standards for the District. Serves as staff to the Governing Board in recommending and developing annual and multi-year goals and objectives in accordance with Federal and State air quality regulations and requirements.

Reviews new and proposed legislation and regulations and determines potential effect and requirements of the proposed programs; coordinates and incorporates requirements of new federal and state laws and regulations with existing District plans, permitting procedures, rules and regulations. Advises Governing board in a timely manner regarding discretionary policy issues. Directs the preparations and dissemination of reports, informational materials, and other written documents and presentations.

Represents the District in various dealings with other governmental agencies, permittees, potential permittees, and the public regarding rule and permit enforcement, fines, fees, permits, variances, and local district regulations; and coordinates air quality matters with the public and government agencies within the District.

Represents the District before the media, other agencies and the public; acts as expert witness in court; lobbies State and Federal legislators under direct guidance from the governing Board; provides reports and testimony as required by the Grand Jury. Works with District Counsel and other attorney consultants on current and potential litigation.

Employment Standards

Education and Experience:
Graduation from a college or university with a Master's degree in science or engineering; five (5) years experience managing a scientific or engineering program, preferably in air quality or two (2) years as a Deputy Air Pollution Control Officer; five (5) years experience in a responsible position with a governmental regulatory agency, establishing and maintaining on behalf of the regulatory agency positive and effective working relationships with regulated sources, including large governmental organizations, such as those subject to air pollution control district regulations in California; or any combination of training and/or experience that could likely provide the desired knowledge and skills.

Knowledge:
Air quality programs and regulations; principles, practices and research methods related to the analysis and control of air pollution; social, political and environmental issues influencing air quality management programs; applicable federal and state laws, rules and regulations; principles and practices of effective public relations and legislative advocacy; current developments, literature and sources of information regarding air quality management activities; principles and practices of organization, management, governmental budgeting and human resource administration; planning practices and techniques; functions and obligations of an elected board.

Skills:
Planning, organizing, coordinating, and directing air quality management program activities; interviewing, appointing, motivating, and evaluating staff and providing relevant training and professional development; developing and implementing goals, objectives, policies, procedures,

work standards, and internal controls; analyzing complex technical and administrative problems, evaluating alternative solutions, and implementing effective courses of action; interpreting, explaining, and applying District rules and regulations and state and federal laws; representing the District effectively in a public forum; promoting cooperative relationships with governmental, industrial, and public groups concerned with air pollution control programs; preparing clear and concise reports, correspondence, and other written materials; and exercising sound independent judgment within policy and legal guidelines.

Physical Demands and Working Conditions

This is both an office job requiring daily use of a computer and video terminal, as well as an occasional field job requiring travel to remote sites and off-road vehicle travel. Travel is mainly by automobile, but may on occasion be by all-terrain vehicle. Physical demands include occasional lifting up to ten (10) pounds, walking, some bending, stooping and squatting. The environment is generally clean with occasional exposure to field conditions with dust, mud, fumes, odors, or noise.

Special Requirements
A valid California driver's license for equipment to be operated.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

Deputy Air Pollution Control Officer

Summary
Under administrative direction, plans and implements the District's air pollution program; represents the District in the APCO's absence; and performs other related duties as required.

Principal Duties
(The following used as a partial description and is not restrictive to duties required.)

Plans, develops, and reviews test designs and research projects of dust mitigation; coordinates activities with consultants, government agencies and other interested parties on research projects; directs test operations; reviews and edits technical reports; participates in management meetings for purpose of selecting projects for funding and determining overall goals and objectives of the District.

Develops and implements air pollution control programs for regions that violate air quality standards; revises rules for plans as necessary.

Supervises the enforcement of air pollution regulations and permitting activities; implements new programs and regulations; approves permits for industrial sources of air pollution; represents the District at variance hearings; reviews and comments on environmental impact documents for new projects; reviews new air pollution laws and participates in the development of District policy affected by laws.

Serves as liaison to the public, industry and government agencies on air pollution related issues; coordinates and organizes advisory groups; seeks State and Federal funding for special projects and air quality plan development; represents the District at public meetings and makes presentations to the public and scientific community.

Supervises the Air Quality Specialist and Projects Manager, reviews and analyzes enforcement reports; interviews and makes hiring recommendations; evaluates the performance of subordinates; participates in the implementation of discipline of subordinates; provides technical guidance and review in enforcement and permitting.

Employment Specifications

<u>Knowledge of:</u>
Applicable laws and regulatory codes related to the development and implementation of air quality management programs; identification methods for air quality problems; air pollution control devices; fugitive dust control methods; ambient air monitoring devices; basic theory and principles of chemistry, biology and physics; planning practices and techniques.

Ability to:
Analyze administrative and research problems and recommend solutions; prepare technical reports and presentations; reduce complex issues into understandable terms for laymen; design test protocols; develops project work plans and schedules; establish and maintain working relationships with staff, public, commercial and industrial sources, and other regulatory agencies.

Skill in:
Advanced mathematics and statistics; use of microcomputer software applications.

Education and Experience:
Graduation from college with a Bachelor's degree in engineering, atmospheric science or a related field and five years of experience managing an air quality program including planning, enforcement and permit writing or graduation from college with a Master's degree in engineering, atmospheric science or a related field and three years of experience managing an air quality program including planning, enforcement and permit writing or any combination of training and/or experience that could likely provide the desired knowledge and abilities.

Physical Demands:
The job requires occasional travel by car. Physical demands include occasional lifting up to 25 pounds, walking, some bending, stooping, and squatting.

Special requirements:
A valid California driver's license for equipment to be operated. Certification by the Air Resources in Visible Emission Evaluation must be obtained within the first six months of employment.

Working Conditions
This position is an indoor desk job. Environment is generally clean with limited exposure to conditions such as dust, fumes, odors, or noise. Video terminal is used on a daily basis.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

Director of Technical Services

Summary
This is a management-level (exempt) position. Under administrative direction of the Air Pollution Control Officer, the Director of Technical Services (DOTS): manages the operation and personnel of the District's Owens Lake and Mono Lake field operations (SB 270); manages data collection on the SB 270 projects; designs and supervises research projects and studies; participates as a team member in the District's air quality planning operations; acts as senior advisor to the Air Pollution Control Officer; and performs other related duties as required.

Primary Duties

The following is a description of primary duties, and is not restrictive of other duties that may be assigned by the Air Pollution Control Officer.

Participates as a team member in the general design, implementation and operation of the District's SB 270 field program based in Keeler, California; coordinates field activities with consultants and outside researchers on District projects, participates in District operations management meetings.

Designs and prepares field protocols for installation and operation of monitoring and sampling equipment; researches and selects appropriate instrumentation and equipment; resolves operational problems of the instrumentation and equipment. Oversees operation of data network hardware and software. Coordinates data collection operations with data analysis operations. Reviews monthly data for accuracy.

Prepares and edits reports regarding air monitoring and dust mitigation; assembles and reviews data for analysis and summaries. Prepares Board reports for the purchase of equipment and other field related activities.

Supervises and assists personnel in the Keeler field office in the operation of air monitoring programs, data collection and research activities; interviews and makes hiring recommendations; evaluates the performance of subordinates; participates in the implementation of discipline of subordinates; trains new personnel in procedures and provides technical guidance in solving equipment problems.

The DOTS generally reports to the District's Keeler field office four days per week and the District's Bishop office one day per week.

Employment Specifications

<u>Knowledge of</u>:
Theory and principles of environmental sciences; research and design methods; data sampling techniques and practices; theory and principles of electronics and computer hardware and software;

principles and practices of supervision and training; principles and practices of project management; administration procedures, including personnel practices, work organization and resource evaluation; budget preparation and management; federal, state and local regulations related to air pollution control.

Ability to:
Analyze scientific problems and studies and recommend courses of action; prepare technical reports and presentations; establish and maintain working relationships with staff, public, commercial and industrial sources, and other public and regulatory agencies. Manage, supervise, oversee, assist and discipline employees.

Skill in:
Operation of air monitoring and other equipment related to the collection of data for air pollution control; use of microcomputer software applications and microcomputer/electronics hardware. Ability to write scientific and administrative reports, prepare budgets and track expenditures. Personnel management.

Education and Experience:
Graduation from college with a Bachelor's degree in engineering, environmental sciences or related field and five years experience in planning, design and implementation of environmental monitoring systems or any combination of training and/or experience that could likely provide the desired knowledge and abilities. A Master's degree in a related field can substitute for two years of research experience. At least two years experience managing and supervising employees is required.

Physical Demands:
This is essentially a desk and field work job. Field work requires standing and walking up to 50% of the time. Field work requires occasional lifting, pulling and pushing of materials up to 40lbs. Occasional bending, twisting, squatting and working on uneven surfaces. Job requires occasional travel by motor vehicle and all-terrain vehicle.

Special Requirements:
A valid California driver's license for equipment to be operated.

Working Conditions
Environment is generally clean with limited exposure to conditions such as dust, fumes, odors, or noise. Works outside on regular basis to coordinate field work with exposure to extreme weather conditions (hot, cold, wind) and dust. Video terminal is used on a daily basis.

Salary
Proposed salary grade: **Grade 72.** Currently $6,322 (Step A) to $7,685 (Step E) per month.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

Geologist

Summary

Under general direction, conducts professional research studies of dust control of dry lake beds; participates as a team member in the long term planning and review of technical research projects; and performs other related duties as required.

Primary Duties

(The following is used as a partial description and is not restrictive to duties required.)

Implements District research studies and oversees contracted studies involving issues of soils, geology and hydrology; develops test protocol; oversees the installation of equipment and organization of materials for projects; coordinates and participates in the collection of data including field observation, soil samples, water samples and wind tunnel tests.

Organizes and performs analysis of field samples; maintains data base of field tests and evaluates data; reviews scientific information of related studies; prepares reports describing findings.

Participates as a team member in the general design, schedule and review of technical research projects; reviews research proposals submitted by consultants and research in still institutions; confers with consultants and outside researchers on District and related projects; prepares proposals for District research projects; prepares budgets for approved projects; participates in management and staff meetings.

Represents the District at professional conferences and meetings regarding geology and hydrology; makes technical presentations of research findings.

<u>Knowledge of:</u>
Thorough knowledge of geology, soils, and hydrology; basic theory and principles of botany and geochemistry ; research design and methods; data sampling techniques and practices.

<u>Ability to:</u>
Analyze scientific problems and studies and recommend courses of action; organize large amounts of data; prepare technical reports and presentations; establish and maintain working relationships with staff, consultants and other public and regulatory agencies.

<u>Skill in:</u>
Advanced mathematics and statistics; use of microcomputer software applications.

<u>Education and Experience:</u>
Graduation from college with a Bachelor's Degree in geology or related field and three years of research experience or a Master's degree in geology or related field involving field research or

any combination of training and/or experience that could likely provide the desired knowledge and abilities.

Physical Demands:
This job is a combination of field and desk work. Field work which is performed on a frequent basis requires standing and walking up to 50% of the time. Field work requires occasional lifting, pulling and pushing of materials up to 40 lbs. Occasional bending, twisting, squatting, and working on uneven surfaces. Job requires frequent travel by car or off road vehicle.

Special Requirements:
A valid California driver's license for equipment to be operated. Operation of off-road vehicles.

Working Conditions
Works outside on a frequent basis to conduct or coordinate field work with exposure to extreme weather conditions (hot, cold, wind) and dust. Video terminal is used on a daily basis.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

Research and Systems Analyst I / II

Summary

Under general supervision, plans, organizes, maintains and analyses a variety of scientific relational databases; maintains and repairs computer equipment; and performs related duties as required.

Distinguishing Characteristics

Research and Systems Analyst I — The entry class of the series. Incumbents learn the air monitoring and District research procedures and practices to analyze resulting data of various databases. Employee performs computer maintenance and repair activities independently and performs programming assignments with assistance.

Research and Systems Analyst II — The fully experienced journey level class of the series is responsible for database maintenance in a particular area, but can act as backup in all areas of information technology work. Incumbent is responsible for planning the design of data analysis and writing programs to manipulate data within relational databases, as well as analysis of data. Employee is responsible for maintenance of specialty computer equipment and performing a wide variety of repairs and installations. They may also lead and coordinate the work of others for specific work projects.

Primary Duties

(The following is used as a partial description and is not restrictive to duties required.)

Organizes and analyses air monitoring, compliance, GIS, research projects and other databases; writes or assists in writing programs to manipulate data; processes data through in-house programs, spreadsheets and databases; reviews the quality of incoming data and data summaries; estimates data when certain components are not available according to established protocol; summarizes computer-generated results in tables, graphs, maps, diagrams and documents suitable for presentation or incorporation into the District GIS system or computer modeling.

Installs hardware and software including peripherals and resolves any operational problems; diagnoses and repairs hardware; installs equipment upgrades; provides users with technical assistance and training; reformats data for transfers between PC Arc/Info and Autocad; assists in ordering hardware and materials needed for District computer operations; organizes and catalogs software library.

Coordinates and trains others in data collection work such as GPS operations; plans or assists in planning new information technology work; plans an performs field work.

Processes and provides data and maps for requests from other agencies and consultants; assists in air quality calculations, modeling and performing risk assessments; reviews proposals using specific databases.

Employment Specifications

Knowledge of:
Both Classes — Excel, Access, relational database manipulations; personal computer technology and applications; techniques and practices of hardware and software troubleshooting and repair. Computer components such as I/O ports, hard drives, graphic cards, monitors, modems, digitizers, plotters and laser printers; Windows and other graphical user interfaces; word processing; database, spreadsheet and programming applications; scientific methods and procedures.

Research and Systems Analyst I — GIS systems; GPS systems; modeling applications; speciality programs related to air monitoring; networking.

Ability to:
Both Classes — Analyze computer system problems and develop solutions; prepare technical reports and presentation; establish and maintain working relations with staff, public agencies, consultant and vendors; work independently.

Research and Systems Analyst II — Plan long-term projects from initial data collection efforts to end product involving other staff members; coordinate the work of others.

Skill to:
Both Classes — Use of personal computer software applications; advanced mathematics modeling and statistics; manual dexterity.

Education and Experience:
Both Classes — Graduation from college with a Bachelor's degree in a scientific field with some experience in scientific research or computer science, including some experience in scientific research and one year of experience in relational database manipulations and programming or any combination of training and experience that provides the required knowledge, skills and abilities.

Research and Systems Analyst II — Two years of experience providing technical services in maintaining computer equipment and databases using specialty software or any combination of training and experience that provides the required knowledge, skills and abilities. A Master's degree in a scientific field requiring field research and computer science may substitute for one year of the required experience.

Physical Demands:
This is primarily a desk job with occasional periods of outdoor physical activity. Physical demands include occasional lifting and carrying up to 40 pounds; waling, some bending, stooping and squatting.

Special Requirements:
A valid California driver's license for equipment to be operated.

Working Conditions
Works outside on an occasional basis to conduct or coordinate field work with exposure to extreme weather conditions such as heat, cold, wind, dust, rain, snow and mud on an occasional basis. Computer monitor and keyboard are used on a constant basis. May drive to other District locations to maintain equipment.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

Senior Research and Systems Analyst

Summary
Under general supervision,

Principal Duties
(The following is used as a partial description and is not restrictive to duties required.)

Manages, administers, coordinates, supervises and participates in the processing of research and monitoring data; writes programs for restructuring data from a variety of formats; designs data bases and supervises input, output and filing; transfers and reformats data from non-PC systems; performs and supervises data analysis and modeling.

Researches, selects and purchases microcomputer hardware and software; installs hardware and software including peripherals and resolves any operational problems; diagnoses and repairs hardware; installs equipment upgrades; provides users with technical assistance and training.

Assists in preparation of and/or writes portions of State Implementation Plan documents and other reports; assists in the selection and supervision of environmental consultants; reviews project proposals and contracted environmental surveys and reports; assists in environmental field surveys.

Supervises Research and Systems Analysts I/II; provides training in hardware repair and systems.

Employment Specifications

Knowledge of:
Personal computer technology and applications; techniques of computer hardware and software evaluation; techniques and practices of hardware and software troubleshooting and repair; micro computer operating systems; word processing, database, spreadsheet and programming applications; scientific research methods and procedures; training practices and techniques.

Ability to:
Analyze computer system problems and develop solutions; prepare technical reports and presentations; establish and maintain working relationships with staff, subordinates, public agencies, consultants and vendors; plan and schedule work.

Skill in:
Use of microcomputer software applications; computer programming; advanced mathematics, modeling and statistics; manual dexterity.

Education and Experience:
Graduation from college with a Bachelor's degree in an environmental science or related field and three years of research experience involving data analysis and programming or a Master's degree in an environmental science involving research or any combination of training and/or experience that could likely provide the desired knowledge and abilities.

Physical Demands:
This is essentially an indoor an indoor desk job. Physical demands include occasional lifting of objects up to 40 pounds, walking, some bending, stooping and squatting. with occasional periods of outdoor physical activity. Physical demands include occasional lifting and carrying up to 40 pounds; waling, some bending, stooping and squatting.

Working Conditions

Environment is generally clean with limited exposure to conditions such as dust, fumes, odors, or noise. Video terminal is used on a daily basis.

Special Requirements
A valid California driver's license for District vehicles to be operated.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

Field Services Technician I/II

Summary

Under general supervision, assist in the collection of information on the location, frequency duration and severity of dust storms from the Owens and Mono Lakes and the identify dust sources using scientific methods and instrumentation such as sand flux monitors, video surveillance, air monitoring equipment, observation mapping, and GPS surveying; and perform related duties as required.

Distinguishing Characteristics

Field Services Technician I: This is the entry and training level class of the series. Incumbents learn how to operate and maintain all scientific field instrumentation and air monitoring instruments used to identify sources of dust on the Owens Lake and the surrounding areas that contribute to pollutant concentrations recorded at air monitoring stations around the lake. May assist with similar efforts at Mono Lake.

Assist other Technical and Air Monitoring staff in the design, construction, installation and operation of air monitoring and scientific field instrumentation throughout the District.

Field Services Technician II: This is the fully experienced, journey-level class of the series. Incumbents are responsible for the installing, operating, and maintaining air quality stations and scientific field equipment related to the Owens and Mono Lakes Dust ID Program, including air monitoring equipment, sand flux monitors, video surveillance, network communications, datalogger programming. Serves as lead on air monitoring, sand flux monitoring, meteorological or other special monitoring projects throughout the District.

Principal Duties

(Any one position may not include all duties listed, nor do the examples listed cover all the duties that may be performed.)

Installs, operates, maintains, and repairs air monitoring instrumentation and equipment including weather monitoring stations, particulate monitors, surveillance cameras, network and radio communication systems, and sand flux monitoring sites; preforms routine servicing and preventative maintenance of equipment; calibrates air monitoring and meteorological instruments according to GBUAPCD, State and Federal specifications; troubleshoots and repairs malfunction instruments and components.

Collects dust storm information and maintain instrumentation; downloads information into the computer system.

Using a Geographical Positioning System (GPS) unit conducts land survey data and downloads information into the computer to produce maps of recently active dust source areas; conducts visual surveys of the lake bed determining extent and recentness of aeolian surface damage requiring knowledge of sedimentary structures such as wind-formed ripple marks of erosion and deposition accomplished by the wind.

Marginal Duties
Assists other staff in the design, construction, installation and operation of air monitoring and scientific field instrumentation. Preforms scheduled and unscheduled service and repair of ATV's, vehicles, generators, shop equipment and other small machinery; maintains the Keeler office areas and grounds in good repair and order.

Employment Specifications

Knowledge of:
Both classes: Basic principles and theory of scientific fieldwork and use of instrumentation to obtain defensible data; safe work practices.

Field Services Technician II: Global Positioning System (GPS) surveying techniques; local geological structures, project management; basic Geographical Information System (GIS) system operations; computer graphics and video editing. Principles of operation of scientific equipment; theories and principles of physics and chemistry as applied to installation, operation, calibration, maintenance, and repair of air monitoring instruments and equipment. Analyze, diagnose, and solve technical instrumentation problems; understand and work with a variety of technical manuals; set up, maintain, and troubleshoot network and radio communication systems. Have the ability to work independently with a minimum of supervision and strong computers skills, as well as skills in detail oriented work, organization, communication, and follow through.

Skills in:
Operation of ATV's and off road vehicles; troubleshooting and repair of equipment and instrumentation; operation of video software and equipment.

Education and Experience
Field Services Technician I:
1) Four years of experience in the operation and maintenance of scientific or mechanical instrumentation, machinery, or equipment; or
2) completion of two years of college with major course work in electronics, and/or a Bachelor's degree in an environmental science or electronics, or
3) any combination of training and/ or experience that could likely provide the desired knowledge and abilities.

Field Services Technician II:
1) Four years of experience in the operation and maintenance of scientific or mechanical instrumentation, machinery, or equipment, experience in Information Technology (IT) including network communications, programing, data storage systems and/ or two years experience as a Field Services Technician I or equivalent; or

2) Bachelor’s degree in an environmental science or electronics and/or two years of experience as an Field Services Technician I or equivalent, and/or experience that could likely provide the desired knowledge and abilities.

Promotion from Field Services Technician I to a Field Services Technician can take place after two years at an FST I and passing of a promotional examination.

Physical Demands:
Involves active physical work (bending, stooping, squatting, twisting, reaching, working on irregular surfaces), but not prolonged heavy exertion. The majority of the time is spent standing or sitting. Work also involves lifting, pushing, or pulling objects up to 20 pounds on constant basis and up to 50 pounds on an occasional basis; strength and endurance to perform shoveling, jacking and lifting to free stuck vehicles on an occasional basis, strength, endurance and coordination to walk through water and mud for distances of several hundred yards from ankle to knee depth on a frequent basis.

Special Requirements:
A valid Class C California driver’s license. The work involves off-road vehicles. Work overtime, after hours and respond to emergency calls as needed. Must be capable of wearing and be certified to use a full face respirator and working for short periods (5 to 30 minutes) within high concentration dust plumes to travel to a clear dust free area.

Working Conditions:
Exposure to extreme condition such as: heat, cold, wind, dust, rain, snow, and mud on a frequent basis. Works longer hours during dust storms from sunrise to sunset on a frequent basis and works other occasional overtime. Uses computers on a frequent basis. Operates ATV’s and 4x4 vehicles on a frequent basis.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

Air Monitoring Specialist

Summary

Under general direction, supervises the daily activities of the Instrument Technicians including preparation of progress reports and the installation, maintenance and repair of air pollution measuring or testing devices and instruments and performs the more complex work; assists in the design and modification of air pollution devices; implements and administers special programs such as the toxic “hot spots” program; and performs other related duties as required.

Primary Duties

(The following is used as a partial description and is not restrictive to duties required.)

Assigns, directs and reviews the activities of the air pollution monitoring staff in collection, managing and evaluating data in the detection of atmospheric pollutants; trains, evaluates and supervises instrument technicians; implements informal disciplinary actions as needed; assesses work load requirements and establishes priorities and completion dates; develops, implements and oversees the air monitoring quality assurance program; approves requests for air quality data and directs staff response.

Develops and implements special air monitoring project programs such as the toxic “hot spots” program; reviews technical plan and reports such as emission inventory plans, reports and risk assessments; writes technical reports for special air monitoring projects; develops and improves sampling techniques; designs and modifies equipment; may perform inspections and respond to complaints.

Coordinates activities with other agencies and contractors; prepares or supervises the preparation of reports, correspondence, and scientific papers documenting air quality monitoring activities such as monthly data summaries and quarterly quality assurance reports required by California Air Resources Board; responds to public inquiries relative to air quality; reviews and prepares specifications for air pollution and meteorological equipment; provides budget input regarding resource and equipment and supply needs.

Employment Specifications

<u>Knowledge of</u>:

State and regional air quality regulations; including the air toxic “hot spots” program; underlying principles of the construction, maintenance and use of scientific instruments; principles of chemistry, electronics and physics; principles of supervision; basic budget preparation and computers.

Ability to:
Direct, coordinate, supervise, train and evaluate the work of the air monitoring staff; assess monitoring requirements; read plans, blueprints and electrical wiring diagrams; analyze electronic and instrument problems and implement solutions; prepare comprehensive technical reports; establish and maintain working relationships with subordinates, other staff, state agencies and the public.

Skill in:
Manual dexterity; producing simple electronic diagrams and sketches; use of microcomputer software applications; trouble shooting instrumentation problems.

Education and Experience:
Graduation from college with a Bachelor's degree in chemistry, physics, an environmental science, an atmospheric science engineering or a related field and four years experience in the field of air pollution with two years of supervisory or lead experience or any combination of training and/or experience that could likely provide the desired knowledge and abilities.

Possession of an advanced degree in chemistry, physics, environmental science, or atmospheric science engineering is highly desirable. Experience in monitoring geothermal power plant operations is desirable.

Physical Demands:
This job is a combination of field work and desk job. Field work involves active physical work (bending, stooping, squatting, twisting, reaching, working on irregular surfaces) but not prolonged heavy exertion. Work also involves lifting, pushing or pulling of objects up to 20 lbs. on a frequent basis and up to 60 lbs. on an occasional basis. Work also involves climbing ladders and working in high places; job requires travel by car or off road vehicle.

Special Requirements:
A valid California driver's license for equipment to be operated. Operation of off road vehicles. Work overtime, after hours, and respond to emergency calls. Certification by the Air Resources Board in Visible Emission Evaluation must be obtained within the first six months of employment.

Working Conditions
Inside environment is generally clean with limited exposure to conditions such as dust, fumes, odors, or noise. Outside field work involves exposure to extreme weather (hot, cold, wind) and dust. Video terminal is used on a weekly basis.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

Air Monitoring Technical Specialist

Summary

Under general direction, oversees operation of the Owens Lake air monitoring network from site location, to design, permitting, installation and operation. Supervision of Air Monitoring Technician I and II personnel to assure meeting required data capture within requirements set by the EPA, State and District. Completes, assists, reviews, tracks and directs all aspects of air monitoring from field to final report presentation. Works directly with District management and other agency representatives to facilitate a smooth implementation of all air monitoring completed on and around Owens Lake.

Primary Duties

(The following is used as a partial description and is not restrictive to duties required.)

Assists the Director of Technical Services in the oversight of the Owens Lake air monitoring program by tracking permits with private and government land owners, design and oversight of site construction, procurement of materials and equipment, operational debugging, technician training and periodic review and assistance to the site operators. Communicates monthly with the Bishop office to assure air monitoring filters, data and forms are received in a timely manner. The position provides assistance to air monitoring staff through direct completion of the work, follow-up staff training and procurement of supplies to reduce downtime. Responsibility requires reporting directly to the Director of Technical Services the status of material and human resources along with recommendations to alleviate any equipment failure or procedural issues requiring change.

Along with the Director of Technical Services acts as District observer on Owens Lake projects completed by LADWP and their contractors assuring compliance with standard monitoring protocols. Aides in the organization, completion, analysis and presentation of special projects; writes descriptive portions of technical reports; using computer software such as Microsoft Office, Adobe Illustrator and Photoshop to prepare graphics for presentations. Sits in meetings as requested to provide guidance in the development and operational procedures for air monitoring projects.

Marginal Duties

Operates or assists in the operation and maintenance of air monitoring stations on and around Owens Lake. Repairs and services air monitoring equipment. Assists in design and operation of special Owens Lake projects as requested. Completes and maps dust source plume observations during dust storms from a designated observation point.

Employment Specifications

<u>Knowledge of</u>:

Operation, maintenance and advanced repair of air monitor samplers, especially particulate PM-10 and PM-2.5 samplers. A well developed knowledge of the use of computers for word processing, spreadsheet, and data collection and analysis software. The ability to effectively communicate information through employee supervision to achieve completion of assignments without missing management deadlines.

Ability to:
Organize, schedule and implement all aspects of the installation of an air monitoring station with little or no supervision. Train and supervise air monitoring technicians in the operation and maintenance of air monitoring samplers. Troubleshoot and repair all components of an air sampler without supervision and through clear communication with the sampler manufacturer. Establish and maintain an effective working relationship with staff, vendors and contractors.

Education and Experience:
Completion of a Bachelor's degree from an accredited college or university in a physical science, engineering or environmental field of interest and five years experience in a scientific position; or completion of eight or more years in the air monitoring field achieving at least two years at the Technical Air Monitoring II level position or any combination of education and experience that provides the required knowledge, skills and abilities. Previous supervisory experience is desirable.

Special Requirements:
A valid California driver's license is required for operation of District vehicles. The person must be capable of wearing a full face respirator and working for short periods (5 to 30 minutes) within Owens lake dust plumes while traveling to a clear dust-free area.

Working Conditions
Exposure to extreme conditions such as: heat, cold, wind, dust, rain, snow, and mud on a frequent basis. The position may work longer hours during dust storms from sunrise to sunset on a frequent basis and works other occasional overtime. Use of a computer monitor and keyboard on a frequent basis is required. Operation of ATVs and 4x4 vehicles on a frequent basis will be required on Owens Lake.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

Air Monitoring Technician I / II

Summary

Under general supervision, installs, operates, maintains, calibrates, and repairs instrumentation and equipment associated with air quality and meteorological monitoring. Calibrates balances, weighs air quality filter samples, and maintains gravimetric laboratory systems to required regulatory specifications.

Distinguishing Characteristics

Air Monitoring Technician I: The entry and training level class of the series. Incumbents learn air monitoring station operation, including data collection and analysis techniques and installation, operation, and repair of air and meteorological monitoring instruments; gravimetric laboratory techniques, including weighing filters, calibrating balances, computer spreadsheet data entry, and elementary data analysis.

Air Monitoring Technician II: The fully experienced, journey level class of the series. Incumbents are responsible for installing, operating, and maintaining air quality monitoring stations and research project monitoring sites with a variety of instruments, including the repair and installation of instruments and for maintaining laboratory systems, including the balances and the temperature/relative humidity control system. Serves as lead on air monitoring, meteorological or other special monitoring projects.

Principal Duties:

(Any one position may not include all duties listed, nor do the examples listed cover all the duties that may be performed.)

Installs, operates, maintains, and repairs air monitoring instrumentation and equipment including weather monitoring stations, particulate monitors, and ambient air gas analyzers; performs routine servicing and preventative maintenance of equipment; calibrates air monitoring and meteorological instruments according to GBUAPCD, State and Federal specifications; troubleshoots and repairs malfunctioning instruments and components.

Collects and tabulates data from sampling equipment; programs data loggers; reviews data for accuracy and takes appropriate action to remedy faulty data collection; prepares data reports; documents information and activities in instrument and station log books, on maintenance sheets, and other documents as required. Documents all repairs, calibrations, notes on instrument performance, and instrument modification in appropriate logbooks or on forms.

Inspects, weighs, and catalogs particulate filters; operates, maintains, and calibrates analytical and micro balances; operates and maintains the District's laboratory systems, temperature and humidity control systems; cleans and assembles filter cartridges; inputs data from filter samples collected throughout the District into a computer database; prepares initial computer analysis of particulate data; coordinates work activities with the station operators.

Installs, operates, maintains, and repairs sand motion monitoring equipment; observes and documents dust storm activity; performs simple chemical and physical tests such as weighing, sieving, electrical conductivity, hydrometer analyses on soils samples and input of resultant data into computer database.

Assists other technicians in installation and set up of new equipment and instrumentation; responds to emergency service calls; provides vacation and temporary replacement help as required.

Performs other comparable duties as assigned.

Employment Specifications

Knowledge of:
Both classes: Basic principles and theory of environmental sciences; basic principles and theory of electronics; safe work practices.

Air Monitoring Technician II: Principles of operation of scientific equipment; theories and principles of physics and chemistry as applied to installation, operation, calibration, maintenance, and repair of air monitoring and laboratory instruments and equipment; air pollution terminology; federal and state regulations regarding air monitoring and quality assurance; laboratory practices; personal computer software packages including spreadsheet, database, word processing and other computer software packages, especially: Microsoft Excel, Corel Word Perfect, Microsoft Word, etc.

Ability to:
Both Classes: Learn mechanical, electronic, and computer systems; learn and work independently; prioritize and schedule work assignments.

Air Monitoring Technician II: Plan and manage the installation of monitoring systems; analyze, diagnose, and solve technical instrumentation problems; understand and work from a variety of technical manuals. Have the ability to work independently with a minimum of supervision and strong math and computer skills, as well as skills in detail oriented work, organization, communication, and follow through.

Skill in:
Solving algebraic equations, use of hand and power tools, manual dexterity, and use of computer software applications.

Education and Experience:
Air Monitoring Technician I: Completion of two years of college with major course work in electronics, a Bachelor's degree in an environmental science or any combination of training and/or experience that could likely provide the desired knowledge and abilities.

Air Monitoring Technician II: Completion of two years of college with major course work in electronics or a Bachelor's degree in an environmental science and two years' experience as an

Air Monitoring Technician I in air quality monitoring field work or in an air quality monitoring filter laboratory or any combination of training and/or experience that could likely provide the desired knowledge and abilities.

Physical Demands:
Involves active physical work (bending, stooping, squatting, twisting, reaching, working on irregular surfaces) but not prolonged heavy exertion. The majority of the time is spent standing or sitting. Work also involves lifting, pushing, or pulling objects up to 20 lbs. on a regular basis and up to 50 lbs. on an occasional basis. The work involves climbing ladders and working in high places. The work requires travel by car, ATV, or other off-road vehicle on a regular basis.

Special Requirements:
A valid California driver's license is required. The work involves operation of off-road vehicles. Work overtime, after hours and respond to emergency calls as needed.

Working Conditions
The work involves exposure to extreme weather conditions (heat, cold, wind, snow) and dust on an occasional basis. A computer terminal is used on a daily basis.

GREAT BASIN UNIFIED
AIR POLLUTION CONTROL DISTRICT

AIR MONITORING QUALITY ASSURANCE

PM 10 QAPP

APPENDIX E-1

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

BGI, Inc.
PQ200 PM10 SAMPLER

JANUARY 2013

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PQ200 PM10 SAMPLER

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BGI, Inc.
PQ200 AIR SAMPLER

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GREAT BASIN UNIFIED
AIR POLLUTION CONTROL DISTRICT

AIR MONITORING QUALITY ASSURANCE

PM 10 QAPP

APPENDIX E-1

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

STATION OPERATOR'S PROCEDURES FOR BGI, Inc.
PQ200 AIR SAMPLER

JANUARY 2013

E-1.1.0 GENERAL INFORMATION

E-1.1.0.1 Purpose

The purpose of these Standard Operating Procedures (SOP) is to supplement the manufacturer's (BGI) Operator's Manual by describing modifications in hardware or procedures which may have been implemented by the Great Basin Unified Air Pollution Control District (the District). These modifications are designed to assure compliance with the Federal Reference Method for collection of particulate matter 10 microns or smaller (PM10) when using the BGI, Inc. PQ200 Ambient Air Sampler.

E-1.1.0.2 General Description and Theory of Operation

The BGI PQ200 was designated in the Federal Register as a FRM for collection of PM10 (RFPS-1298-125). This sampling system performs all the functions required or recommended in the instrument specification portion of the FRM PM10 standard, including: a fixed flow rate of 16.67 liters per minute (LPM) using a specified PM10 inlet, tubing (downtube), filter holder, and filter cassette. The sampler uses a filter cassette which holds single filters in their individual cassettes.

The sampler draws ambient air through its PM10 inlet and a 46.2 millimeter (mm) diameter Teflon sample filter which traps the PM10 fraction. The sample filter is conditioned and weighed before and after sampling and the resulting difference is the collected PM10 mass. Electronic systems in the sampler are designed to monitor and maintain the flow rate as well as record the elapsed sampling time enabling the sampler to calculate the total sample volume. With this information, the analyzing laboratory will calculate the average PM10 concentration of the sampling period.

The BGI PQ200 Air sampler monitors and regulates the flow rate using a critical orifice, a variable speed pump, and ambient temperature and pressure sensors, all controlled by the sampler's microprocessor and software.

For a more detailed explanation of the sampler's theory of operation, see Section 2: Introduction, of the Operator's Manual and see Figure E-I.1.0.1: Schematic of BGI, Inc. PQ200 Air Sampler.

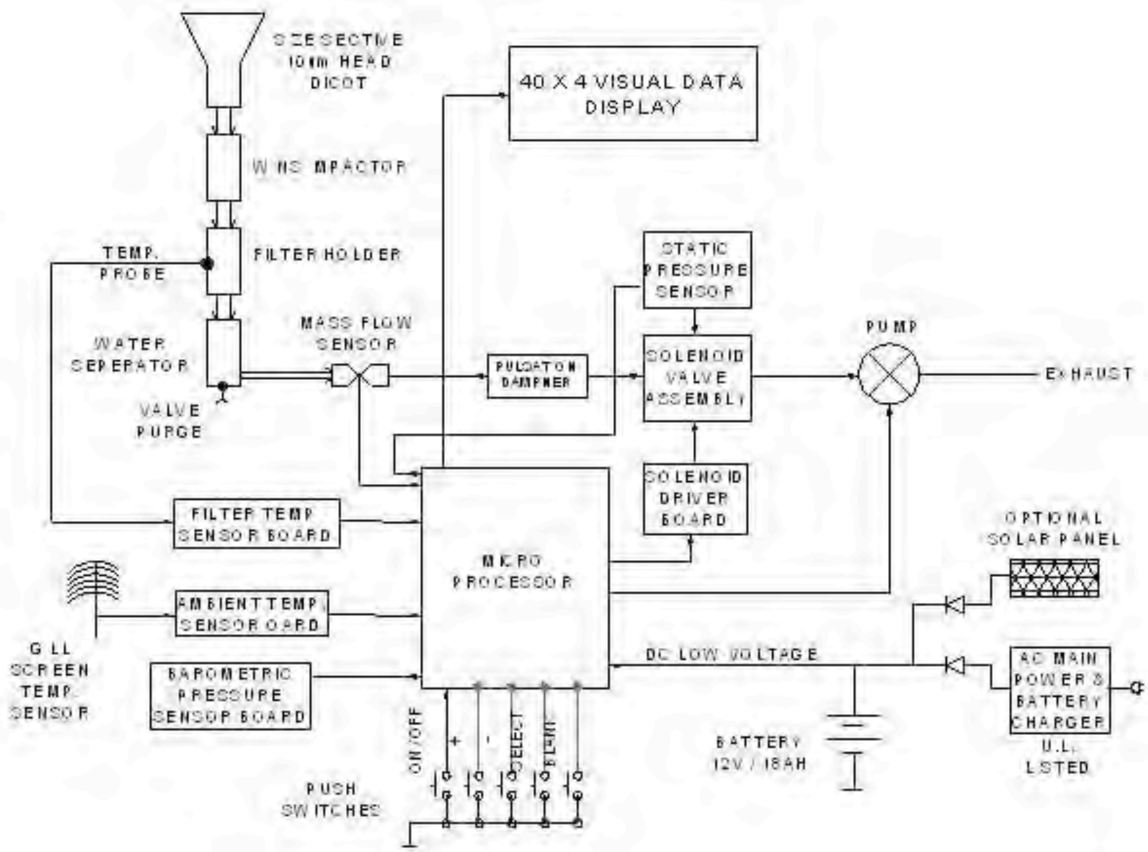

Figure E-1.1.0.1 Schematic of BGI, Inc. PQ200 Air Sampler

E-1.1.0.3 Safety

Installation, operation, maintenance, or calibration of the sampler should only be performed by properly trained personnel. High (120 volts A.C.) voltages are used to power the unit and due to typical elevated installations, the risks of working outdoors at elevation during adverse ambient weather conditions should also be considered. Additional information is provided in Section 1: Cautions and Notices, of the Operator's Manual.

E-1.1.1 INSTALLATION PROCEDURE

E-1.1.1.1 Physical Inspection

Each BGI, Inc. PQ200 Air Sampler purchased should be supplied with the following supplies:

1 PM10 Inlet
1 inlet tube
1 stand kit
1 leak check adapter
1 filter bypass leak check disk
1 filter cassette
1 filter dust excluder ring
1 ambient temperature solar radiation shield
2 sets of filter cassettes and backing screens
2 sets of inlet O-rings
4 accessories required for the collection, storage, and transport of filter samples
1 RS232 interconnect cable
1 copy of the Operator's Manual

Upon receipt of the sampler, inspect sampler and accessories for shortage and for shipping damage. If shortage or damage is found, immediately notify your supervisor, and/or your agency's shipping department.

E-1.1.1.2 Initial Sampler Installation

Follow directions found in Section 1 and 2 of the PQ200 Operator's Manual for installation instructions and consult with your area specialist/engineer or supervisor to assure that installation site complies with Federal and State siting criteria for FRM PM10.

E-1.1.1.3 Initial Sampler Set-Up

Follow directions found in Sections 2, 3, and 4 of the PQ200 Operator's Manual.

E-1.1.2 DATA RETRIEVAL

E-1.1.2.1 Introduction

Field personnel will have the responsibility of ensuring PM10 sampling information for each filter run is properly retrieved. The sampling information from the BGI sampler can be obtained either manually or electronically.

The BGI sampler has a built-in serial communications port that can be used to interface with PC's, modems, and printers. The sampler's communications use N-8-1 protocol (8 stop bits, no parity, 1 stop bit). The sampler is capable of communications over a wide range of baud rates. There are two primary ways to download data from the sampler: Laptop PC or DataTrans.

To manually record sample data, field personnel will complete a District 24-Hour Field Sample Report (see Figure EI.1.0.3). The 24-Hr sample report will contain all information required by 40 CFR Part 50, Appendices J and M.

To electronically record sample data, field personnel can download data via an RS-232 data output connection through which digital data will be exported to a laptop PC or DataTrans unit.

E-1.1.2.2 Download Apparatus Using Laptop PC

1. Laptop PC with communications software or terminal program.

2. Serial cable with D-9 male plug with female pins on one end and a D-9 female plug with male pins on the other.

E-1.1.2.3 Download Procedure Using Laptop PC

1. Connect the serial cable from the PC to the serial port on the sampler.

2. Open the communications software, configure to operate using the N-8-1 protocol and baud rate set on the BGI sampler. Enable the file capture portion of the software package (For Procomm click capture icon or type Alt F1).

3. Select the "Data Transfer" menu from the main menu of the BGI sampler. Select "Summary", "Data Log", or "Pwr Fail Log" depending on the information that is desired to be transmitted. Typically only the summary information will be downloaded. Data Log (5-minute averages) should be downloaded if a problem was encountered during sampling.

4. After a selection is made, the BGI sampler system will send the data over the serial connection to the PC. The terminal window of the communications software should show the data being transmitted.

5. After transmission is completed, disable the file capture capability of the communications software to close the capture file. (For Procomm click capture icon or type "Alt F1"). Disconnect serial cable from sampler and PC.

E-1.1.3 DATA SUBMITTAL (FIELD TO LABORATORY)

E-1.1.3.1 <u>Introduction</u>

Once field personnel have retrieved sampling information either manually or electronically, the sample run information must be forwarded to the laboratory. If the sampling information was recorded manually, a separate 24-Hr sample report will accompany each of the sampled filters to the laboratory. If the sampling information was recorded electronically, the sampling information will be sent to the lab via e-mail. A completed 24-Hr sample report will still accompany the sampled filter(s) to document the chain-of-custody and additional sampling information.

E-1.1.3.2 <u>Sample Chain-of-Custody</u>

The chain-of-custody process begins once the filter is pre-conditioned and inspected by laboratory personnel. After pre-conditioning is complete, filters will be preweighed, placed in cassette filter rings and prepared for shipping. Each filter's unique number will be written on the 24-Hr Sample Report. Laboratory personnel will annotate the preweight of the filter, date and initials on the 24-Hr Sample Report. The 24-Hr sample report and filter(s) will be shipped to the field. When the filter is loaded on the sampler, field personnel will document the date, time and initials of person loading the sampler. After sampling, field personnel will document date, time and initials of person removing the sample from the sampler. Field personnel will document date and time when the filter is prepared for transport. When the filter is transported to the laboratory, the date, time, and person transporting the filter will be documented on the 24-Hr Sample Report. When the filter arrives at the laboratory, the date, time, and person receiving the filter will be noted on the 24-Hr sample report. The filter will then be prepared for postconditioning. The date, time, and name of analyst will be documented once postconditioning begins.

E-1.1.4 QUALITY CONTROL MAINTENANCE PROCEDURES

E-1.1.4.1 <u>General Information</u>

Quality Control (QC) maintenance procedures (checks) are designed to help assure that valid data is produced as a result of proper sampler operation and maintenance in accordance with its federal designation and the manufacturer's operating manual. The maintenance frequency presented in these standard operating procedures should be considered the minimum required even though the actual frequency of performing some of these checks may vary from site to site due to different environmental factors. These may include the sampling schedule, particulate concentrations, or seasonal factors which may require an increase in maintenance frequency. In the event that these checks cannot be performed on schedule, the deferred maintenance should be performed as soon as practical. The QC procedures schedule is presented in Table AI.1.0.1.

When QC checks are performed, the date, results, and any comments should be recorded on the Monthly Quality Control Maintenance Check Sheet for the FRM PM10 Filter Sampler (QC checksheet) presented in Figure E-1.1.0.4. This document will be forwarded to the supervisor on a monthly basis for subsequent review and filing. It is recommended that a copy be made by the operator and kept at the field site for later reference by the operator or a site visitor.

E-1.1.4.2 Daily Checks

During the procedure of unloading the sample cassettes from the sampler, record the sample summary data onto the sample cassette's matching 24-Hr sample report. Also record the run date on the QC checksheet.

Review the summary data for reasonableness and for compliance with Measurement Quality Objectives for FRM PM10 presented in Table E-1.1.0.2. If questionable summary data is seen, download the five (5) minute data averages using the BGI DataTrans or personal computer (PC) and examine these averages for anomalies. Procedures for downloading these data are presented in Section EI.1.2 (Data Retrieval) of this SOP as well as Section 7: Data Logging, in the Operator's Manual. In the event that anomalies are present in the 5-minute averages, troubleshoot the sampler according to instructions in Section 12: Troubleshooting, of the Operator's Manual and notify your supervisor or area calibrator. Also, visually inspect the PM10 inlet's water collector jar and drain it if water is present.

Quality Control Procedure Schedule for
Federal Reference Method PM10 Sampling

	*Daily	Every Month	Every 6 Months	Every 12 Months
Record and Review Run Summary	X			
Inspect or Drain Inlet Water Jar	X			
Perform Leak Check		X		
Disassemble and Clean PM10 Inlet, Downtube		X		
Inspect O-rings and Gaskets		X		
Perform Single Point Flow Rate Check		X		
Clean Interior of Sampler		X		
Clean air Intake Filter and Fan		X		
Perform Single Point Check of Ambient Temp and Press Sensors		X		
Verify Sampler Clock Time		X		
Transport Samples with Temp-logger		X		
Run a Field Blank		X		
Perform as-is Three Point Calibration Verification of Flow Rate, Pressure and Temperature Sensors				X
Verify As-is Condition of Sampler's Interior, Inlet				X
Perform Calibration of Flow Rate, Pressure & Temperature Sensors				X
Calibrate or Re-certify Flowrate, Press and Temp QC Check Standards				X

*or each time sample cassettes are exchanged

Table E-1.1.0.1 QC Procedures Schedule for FRM PM10 Sampling

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT
BGI PQ200 PM-10 24-HOUR SAMPLE REPORT AND CHAIN-OF-CUSTODY

Site Name: ____________________ **Site ID:** ____________________

Transport to Field: ____________ \ ____________
Initial Date

Received in Field: ____________ \ ____________
Initial Date

Pre-Sample Information

Operator: ____________ Filter Install Date: ____________
Filter ID: ____________ Start Date: ________ Start Time: ________
Sampler ID: ____________ Stop Date: ________ Stop Time: ________

Post-Sample Information

Operator: ____________ Filter Remove Date: ____________
Sampler Flags: ________________________________
Elapsed Time: ________ Total Vol (m^3): ________

				Max	Min	Avg
Actual Start Date: ________	Start Time: ________		Amb Temp ('C):	______	______	______
Actual Stop Date: ________	Stop Time: ________		Bar Press (mm Hg):	______	______	______

Avg Flow (LPM): ________ CV%: ________
Oprtr Comments: ________________________________

Transport from Field: ____________ \ ____________
Initial Date

Laboratory Information

	Weight	Duplicate	Date	Analyst
Initial:	________	________	________	________
Final:	________	________	________	________

Comments: ________________________________

BGI DATA SHEET 2.1 3/03

Figure E-1.1.0.4 BGI PM-10 24-Hour Sample Report and Chain-of-Custody Data Sheet

Measurement Quality Objectives for FRM PM10

Requirement	Frequency	Acceptance Criteria
Sampling Period:	all data	1380 to 1500 minutes or MC if <1380 and exceedance of NAAQS
Sampler: Flow rate Flow rate variability	every 24 hrs of operation	 ≤4% of 16.67 LPM ≤4% CV measured ≤10% average for 5 min
Data Completeness:	quarterly	75%
Filter:	all filters	Visual defect check
Monthly QC Check: Flow rate Clock/timer Leak check	monthly	 +/-4% of standard +/-10 min of corrected clock time <80 mL/min for 2 minutes
Calibration: Flow rate Leak check Temperature sensors Pressure sensors	annually or when failed monthly check, following major repair, or after sampler transport	 +/-4% of transfer (xfer) standard <80 mL/min for 10 minutes +/-2°C of xfer standard +/-10 mm Hg of xfer standard
Monthly QC Standards: Flow rate standard Temperature standard Pressure standard	annually	 +/-2% of NIST-traceable standard +/-0.1%C resolution +/-0.5%C accuracy +/-1 mm Hg resolution +/-5 mm Hg accuracy
Calib. Xfer Standards: Flow rate xfer standard Temperature xfer standard Pressure xfer standard	 critical orifice annually annually annually	 +/-2% of NIST-traceable standard +/-0.1°C resolution +/-0.5°C accuracy +/-1 mm Hg resolution +/-5 mm Hg accuracy

Table E-1.1.0.2 Measurement Quality Objectives for FRM PM10

E-1.1.4.3 Monthly Checks

Disassemble and clean the PM10 inlet and sampler downtube. Inspect o-rings for abrasions, breaks, tears, deformations or other damage. If necessary, replace o-rings and lubricate them with a light coating of halocarbon or silicone vacuum grease prior to reassembly. Using the same lubricant, also lightly lubricate any aluminum threads and take extra care that the fine threads are not cross-threaded during assembly. After reassembly, perform a leak check according to instructions in Section 3.2 of the Operator's Manual and record the results on the QC checksheet. If the results of the leak check meet the acceptance criteria found in Table EI.1.0.2, perform a single point flow check according to instructions presented in Section 3.1 of the Operator's Manual. If the results of the leak check do not meet the criteria, troubleshoot the sampler according to Section 12: Troubleshooting, of the Operator's Manual to determine the cause and if a cause cannot be found, notify your supervisor or area calibrator.

Perform the flow check using an actual flow rate or volume measuring device having an accuracy of at least +/-2 percent (%) of full scale (0-20 LPM vol-o-flow, mass flow meter, etc.) and which is calibrated or certified annually against a NIST-traceable standard. If the sampler's flow rate measurement is not within +/-4 percent of the standard's measurement, investigate the cause. If a cause for the flow discrepancy cannot be found, notify your supervisor. Record the date that these procedures were performed and results of the flow check onto the sampler's QC checksheet.

Clean the interior of the sampler chassis with a damp cloth. Remove the air intake filter and clean it with soap and water following instructions found in Section 2.5 of the Operator's Manual. Clean air intake fan blades with a damp cloth or brush if necessary.

Perform both a leak check and a flow check once per month. Perform a single point check of ambient pressure and temperature sensors using a temperature and pressure standard which is calibrated or certified annually against a NIST-traceable standard. If the sampler's measurements are not within the acceptance criteria (+/-4% for flow rate, <80 mL/min for leak check, ±10 mm Hg for pressure, and ±2°C for temperature) of the standard's measurements, examine the sampler for obvious causes as well as following instructions in Section 12: Troubleshooting, found in the Operator's Manual. If the cause of the discrepancy cannot be found, notify your supervisor or area calibrator.

Verify that the sampler's clock time is within ten (10) minutes of standard time as compared to a clock standard such as the telephone service time or other corrected clock. If there is a difference of more than 10 minutes, reset the sampler's clock to within one (1) minute of the standard according to instructions given in Section 7.1 of the Operator's Manual. Record the date that these procedures were performed and the results obtained onto the sampler's QC checksheet.

Field blanks will be implemented at 10% of sampling frequency. This procedure will be initiated by the laboratory and will consist of the laboratory sending or designating a sample cassette as a field blank. The operator will treat this sample cassette in the same manner as a regular sample cassette used for sampling with the sole exception that it will not be used to collect sample. The field blank sample cassette is to be loaded and unloaded from the sampler, transported, stored and shipped as usual, but the sampler will not be programmed for a sampling event using this sample cassette. In order for this field blank to be as meaningful as possible in checking for passive contamination, leave the field blank in the sampler for at least as long as a regular filter cassette stays in the sampler, both before and after the sampling event. Fill-in the appropriate sections of the field blank's 24-Hr sample report and ship blank cassettes alongside valid samples to the laboratory.

E-1.1.4.6 Annual Checks

Every year, the area calibrator will inspect the sampler's interior and PM10 inlet for cleanliness and condition after an as-is three-point calibration verification check has been performed. If any of the sampler's calibrated systems fail to meet the acceptance criteria presented in Table EI.1.0.2, the calibrator must perform a final (three (3) points) calibration of all systems. The operator may perform all necessary repairs and maintenance prior to performing a final calibration of flow rate and all temperature and pressure sensors. Record the results onto the sampler's calibration worksheet and all maintenance performed and date of calibration onto the sampler's QC checksheet.

The operator will have their flow rate, temperature, and pressure QC verification check measurement standards re-certified or calibrated against a NIST-traceable standard. The date that these procedures are performed will be recorded onto the sampler's QC checksheet.

E-1.1.5 SAMPLE FILTER HANDLING AND SHIPPING PROCEDURE

E-1.1.5.1 Presampling Filter Handling Procedures

The laboratory will supply preweighed sample filters, installed in filter cassettes, to the field/site operator. These sample cassettes, along with their respective 24-Hour sample report, will be shipped inside a shipping container. This container should have external markings which designate that the container is assigned to the site operator as well as that it contains preweighed filters which are available for sampling. These markings are necessary to insure that the correct number of filters are delivered to the proper site since different sites will be operating under different sampling schedules. Also, additional markings will alert the operator that the shipment contains sample filters since not all shipments of insulated containers will contain sample filters.

Inside the shipping container, the sample cassettes will be further contained inside the BGI metal filter transport containers which are designed to hold a single cassette. Check the metal container(s) and confirm that each sample cassette has a cassette ID number written on its side and that this number corresponds to the cassette ID number written in a matching 24-Hr sample. If either a cassette or a 24-Hr sample report is received that does not have its matching cassette or 24-Hr sample report, notify the laboratory for further instructions.

Close the metal container leaving the sample cassette inside, attach the sample report forms and store the cylinder under office environmental conditions until ready for loading into the sampler. If the cylinder will be stored with previously received cylinders, store them in such a way that the first received is the first sampled. When ready for sampling, remove the sample cassette(s) from the cylinder and load the filters into the sampler according to instructions in Section 6: Sampling, and Section 10: PM10 Measurement Procedure, of the Operator's Manual. At this time, also fill-in appropriate sections of the sample cassette's matching 24-Hr sample report.

To minimize the possibility of contaminating the sample filter prior to the sampling event, load the sample filter(s) at a time as close as practical to the start of the sampling event. Also, if it appears probable that the surface of the sample filter may be touched during handling, then laboratory grade (non-dusted) latex gloves should be worn.

E-1.1.5.3 Post-sampling Filter Handling Procedures

Remove sample cassette(s) from the sampler according to instructions in Section 2.1 of the Operator's Manual. Install the filter cassette in the metal filter transport container and place cassette shipping container. After filling-in 24-Hr sample report(s), review sample summary data for compliance with Measurement Quality Objectives presented in Table EI.1.0.2. If objectives are not met, investigate the cause and if a cause cannot be found and remedied, notify your supervisor or area calibrator. Note problem in comments section of the 24-Hr sample report as well as on the QC checksheet. After filling-in 24-Hr sample report(s), place report(s) inside a zip-lock plastic bag to avoid condensation. Store transport containers with sampled in the laboratory. Use a method of storage which assures that the oldest samples will be the first transported to the laboratory.

E-1.1.5.4 Shipping and Transport Procedures

When traveling to a satellite PM10 site, the operator should bring a shipping container or cooler. The container will be used to transport the samples to the operator's office or the laboratory.

Upon arrival at the operator's office, the operator will fill-in the portion of each 24-Hr sample report's chain of custody section which asks for time, date, and initials. Next, put the 24-Hr sample reports into a Ziplock bag and place the bag in the transport container with the for storage until ready for transport to the laboratory.

Shipments to the laboratory will be made on a monthly basis by the station operator. Schedule the delivery early enough in the week to avoid arrival on weekends or holidays.

To prepare the samples for transport, remove the cylinder containing the oldest (earliest sample date) sample cassettes and attached 24-Hr sample reports from the shipping container. Open each metal transport container and confirm that each sample cassette has a matching 24-Hr sample report having the same cassette ID number. Fill-in the portion of each 24-Hr sample report's chain of custody which asks for date, time and initials of the technician. If alright, close the container, attach the 24-Hr sample report(s) and place the container in an shipping for transport to the laboratory. Close the shipping container and secure the lid or opening to prevent opening during transport. Hand-carry the container to the analyzing laboratory.

E-1.1.6 TROUBLESHOOTING

E-1.1.6.1 General Information

If a problem is encountered as a result of the review of the sample summary data which may affect the validity of the sample, download and store the five (5) minute averages. Review the 5-minute averages for operational parameters which may exceed limits of measurement quality objectives defined in Table EI.1.0.2 of these procedures. Also refer to Section 3.4: Troubleshooting, of the Operator's Manual for a probable cause and remedy. Notify your supervisor if the problem cannot be resolved. If the perceived problem does not affect sample validity, refer to Section 3.4: Troubleshooting of the Operator's Manual and continue to monitor the problem or correct it. If the problem persists, contact your supervisor or the manufacturer.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

AIR MONITORING QUALITY ASSURANCE

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

APPENDIX E-1.2

CALIBRATION PROCEDURES FOR BGI
PQ200 AIR SAMPLER

DECEMBER 2012

E-1.2.0 BACKGROUND AND GENERAL INFORMATION

E-1.2.0.1 Overview

The calibration of the fine particulate matter samplers whose mass has an aerometric diameter of less than 10 microns (PM10) must be performed on an annual basis. There are several parameters that must be calibrated with this new generation of fine particulate matter samplers. These parameters include flow or volume, temperature, pressure and time. The District has chosen three reference method samplers to monitor for PM10 at this time. These samplers are the BGI PQ200 Sampler, the Rupprecht and Patashnick Partisol-FRM Model 2000 PM10 single channel sampler, and the R & P Partisol Plus Model 2025 Sequential Sampler. Each sampler has a different principle of flow and, therefore, two calibrations are required for this SOP. The primary purpose of the calibration is to determine and/or verify that the volumetric flow rate of the PM10 sampler is at 16.67 liters per minute (LPM), or that the sampler collects particulate from a volume of 1 cubic meter of air per hour. Refer to 40 CFR Part 50, Appendices J and M for further information.

E-1.2.0.2 General Information

The calibration of the BGI sampler should be performed in the following steps:

1) temperature calibration
2) pressure calibration
3) leak test
4) volume calibration
5) verify calibration parameters

All calibration information and data will be recorded on the BGI PM10 Calibration Data Sheet (Figure E-1.2.0.1).

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT
Quality Control - Maintenance Check Sheet / Log
BGI - PQ200 (PM_{10})

Station Name:		Month / Year:	
Station Number:		Site Elevation:	
Property Number/SN:		Technician:	
Project:			

MONTHLY	Date
Calibration/Verification: Temperature (1-pt, ambient air sensor, filter temp. sensor), Pressure (1-pt), Flow Rate (1-pt), Clock, External Leak Check, Internal Leak Check	
Clean impactor housing, jet surfaces, sampler inlet surfaces and down tube	
Empty water from water trap, clean sampler interior, inspect seals, reinstall trap	
Service water collector bottle	
Examine O-rings, replace if necessary	
Collect field blank(s)	
Inspect/service vacuum tube fittings, pump connections, electrical components	

QUARTERLY	Date/Time
QA: Sampler performance audits*: flow rate audit, external leak check, internal leak check, temperature check, pressure check	
*Criteria: Temperature ±2°C / Pressure ±10mm HG / Flow Rate ±4°, Warning ±10% Invalidation or Correction	

ANNUALLY		Date/Time
Replace O-Rings (inlet)		
Calibration:	Ambient temperature multipoint verification	
	Ambient filter temperature multipoint verification	
	Pressure multipoint calibration	
	Flow rate multipoint calibration	
	Rebuild or replace pump (rebuild between 8000-9000 hours of use)	

WHEN OUT OF SPECIFICATIONS (Otherwise at installation & annually)	Date/Time
Ambient temperature multipoint verification and/or calibration	
Filter temperature multipoint verification and/or calibration	
Pressure calibration	
Flow rate multipoint verification and/or calibration	

Comments: ______________________________

Reviewed By: ______________________ Date: ____________

BGI Monthly Verification Form 2.0-10/2009 Page 1

Figure E-1.2.0.1 BGI PM10 Monthly Maintenance Verification Form, Page 1

Date: ____________________ Last Calibration: ____________________

External Lea Pass [ ] Fail [ ]   Internal Leak Test: Pass [ ] Fail [ ]

Sampler: On [ ] Off [ ]

	Temperature / Pressure / Flow Verification		
	Sampler	Standard	% Diff. from Std
Amb. T	°C	°C+273 = ________ °K	
Amb. P	mmHg	hPax.75 = ________ mmHg	
Qactual	VLPM	in.H2O= VLPM	

Flow Rate Verification Variables

Qact = m x {[(delP x Tamb) / Pamb]1/2} + b

delP, "H2O   Tamb = C+ 273   Pamb = ATM(1 ATM=760mmHg)

Target = 16.7 LPM   m = ________   b = ________

Qactual = VLPM

	Make	Model	S/N	Last Calibration
Flow Std				
Temp				
Pres				

Date Inlet Cleaned: ________   Next Pump Service: ________

Comments:

BGI Monthly Verification Form 2.0-10/2009 Page 2

Figure E-1.2.0.1 BGI PM10 Monthly Maintenance Verification Form, Page 2

E-1.2.1 CALIBRATIONS

E-1.2.1.1 Calibration Transfer Standards and Equipment

The BGI calibration kit will be used as the calibration transfer standards. The calibration transfer standards and equipment will be as follows:

1. NIST-traceable critical orifice
2. Calibrated electronic thermometer, or other certified device
3. Calibrated electronic manometer
4. NIST-traceable pressure sensor
5. BGI flow adapter
6. Tubing: _ inch OD, thick walled, surgical rubber, 1 meter in length
   1/8 inch OD, surgical rubber, 3 pieces, 1 foot in length, plus a plastic 1/8 inch “tee”
7. Blank filter(s)
8. Three (3)Two-liter thick walled plastic insulated containers, water and ice
9. Cup heater
10. Calibration forms or laptop computer
11. NIST-traceable timer

A full calibration of the monitor will be conducted annually at a minimum. All data collected during the calibration is to be documented on the BGI PQ200 Annual Calibration/Verification form (Figure E-1.2.1.1)

EI.2.1.2 Certification of Transfer Standards

All transfer standards used for calibrations will be re-certified every 12 months by the manufacturer's or the District's standards laboratory.

EI.2.1.3 Temperature Sensor Calibration

The BGI Samplers employ epoxy coated bead thermocouples to measure temperature at several locations throughout the sampler. The locations are the outside ambient air and the filter holder assembly. A single-point side-by-side calibration will be performed with the filter temperature sensor. The ambient air thermocouple is used to determine the volumetric flow rate of the sampler. Therefore, it is essential that this temperature sensor be tested for accuracy. It will be the only temperature probe that will receive a full three-point calibration.

From the Main Menu of the BGI sampler, arrow down until the “Maintenance” item is highlighted. Next, select the “Calibrate” option.

E-1.2.1.3.1 Ambient Sensor

To calibrate the ambient temperature sensor, remove the sensor from the louvered housing. Place the sensor and the calibration temperature sensor in the ice bath.

Agitate the water until readings on both sensors are stable. Record the readings and repeat the agitation and recording three times.

Repeat this procedure for the ambient temperature bath and for the hot water bath.

E-1.2.1.3.2 Filter Sensor

To calibrate the filter temperature sensor, place the calibration thermocouple near the filter temperature sensor. Allow the cal. device to equilibrate, and when the readings are stable record the calibration device temperature and the sampler filter temperature sensor measured temperature. Note these temperatures on the calibration sheet. Repeat this comparison a minimum of five times.

E-1.2.1.5 Barometric Pressure Sensor Calibration

The barometric pressure sensor of the BGI sampler can be calibrated by comparison with the calibration barometer. Record the make, model, and calibration date of your calibration pressure sensor on the calibration data sheet. Compare the ambient readings of the two sensors throughout the calibration period, a minimum of five separate readings. Record the readings on the calibration sheet.

E-1.2.1.6 Flow Rate Calibration

E-1.2.1.6.1 Leak Check

Before calibrating the flow (volume) of the sampler it is important to ensure that the sampling train does not have a leak. The Andersen sampler was designed to perform automatic leak checks.

Remove the BGI PM10 inlet. Install the leak check adapter to the sampler inlet, and place the valve in the closed position. Insert 46.2mm Teflon filter(s) into the sample filter position of the monitor.

The leak check procedure is accessed from the Main Menu. Select Leak Check, then Enter to initiate the leak-check procedure.

The sampler will pump the system pressure down to approximately 80 mm. When the vacuum reaches that point, a timer is initiated and the vacuum will be tested for 2 minutes.

Record the leak check vacuum and the leak check time on the calibration data sheet.

E-1.2.1.6.2 Flow Rate Calibration

The flow rate of the BGI sampler must be 16.67 LPM in order to correctly select particulate matter smaller than 10 microns in diameter. The purpose of the flow rate calibration is to ensure that the sampler draws the correct volumetric air flow rate. Section 3.1 of the BGI Operator's Manual discusses the sampler flow calibration. The BGI sampler is flow rate calibrated by measuring the flowrate at 3 points using a NIST-traceable critical orifice.

In this calibration procedure, the flow rate is checked at 16.67 LPM. The flow rate for the second calibration point is 18.3 LPM, and the flow rate for the third point is 15.0 LPM. The following steps outline the calibration procedure:

1. The BGI flow rate is tested by placing the critical orifice on the inlet tube of the sampler and attaching the electronic manometer to the orifice with thick walled silicone rubber tubing. Place a filter in the filter holder and make sure the filter has been properly engaged by the manual sampling system. Choose the calibration selection from the Calibrate menu. Press Enter.

2. Record the orifice ID number, calibration date, calibration coefficient(s), initial readings from both the monitor and the orifice manometer, and the temperature and pressure on the calibration data sheet. The sampler should be run for at least 5 minutes to ensure stable readings.

3. The sampler calibration procedure will prompt you to repeat steps 1 through 2 for flow rates of 18.3 and 15.0 LPM.

After the three flow rates have been measured, calculate the calibration device flow rates and compare with the sampler flow rates.

The system will ask if you want to save the calibration. Select Yes to save the calibration if the flow rates on the sampler have differed from those of the calibration orifice by more than 4%, and press Enter.

E-1.2.2 SAMPLER CALIBRATION VERIFICATION

E-1.2.2.1 Temperature Verification

To verify the ambient temperature sensor, place the calibration thermocouple near the temperature sensor in the shade. Allow the calibration device to equilibrate, and when the readings are stable record the calibration device temperature and the sampler ambient temperature sensor measured temperature. Note these temperatures on the calibration sheet. Repeat this comparison a minimum of five times.

E-1.2.2.2 Barometric Pressure Verification

From the Main Menu, select the Maintenance option. Next select the Monitor option. This screen will display the values for the Ambient, Meter, Filter, Inactive thermocouples, and Barometer.

Record the Make, Model, ID Number, Certification Date and Certification Factors for the pressure standard on the calibration data sheet, or laptop calibration program . Read and record three sets of pressure readings from the pressure transfer standard and from the particulate matter sampler in mm Hg. If the difference between the sampler barometer and the calibration barometer is greater than +/-10 mm Hg, the sampler barometer must be recalibrated.

E-1.2.2.3 Flow Rate Verification

The flow rate of the BGI sampler must be 16.67 LPM in order to correctly select particulate matter smaller than 10 microns in diameter. The purpose of the flow rate verification is to ensure that the sampler draws the correct volumetric flow rate. Section 3.1 of the BGI Operator's Manual discusses the sampler flow calibration. The BGI sampler is flow rate verified by measuring the flowrate at 16.67 LPM comparing it with the flow rate measured with a calibration critical orifice.

1. The BGI flow rate is tested by placing the critical orifice on the inlet tube of the sampler and attaching the electronic manometer to the orifice with thick walled silicone rubber tubing. Place a filter in the filter holder and make sure the filter has been properly engaged by the manual sampling system. Choose the calibration selection from the Calibrate menu. Press Enter.

2. Record the orifice ID number, calibration date, calibration coefficient(s), initial readings from both the monitor and the orifice manometer, and the temperature an pressure on the calibration data sheet.

   The sampler should be run for at least 5 minutes to ensure stable readings.

E-1.2.2.4 Clock/Timer Verification

Units of time are used in several aspects of sampler operation. Examples are the start and stop times, volume/flow calculations, run dates, etc. Therefore, it is necessary to document the time setting of the sampler.

Observe the sampler time from the Main Menu, choose "View Run", then "Current Sample". Press "Enter" until you reach the last of 3 screens. The last screen will contain the current sampler time. Enter this value onto the calibration data sheet. At the same time, enter the value of your time keeping device. Identify your time keeping device on the calibration data sheet.

Include the make, model, ID number, date last certified, and bias of your clock.

If the sampler is greater than 10 minutes from true time, reset the system clock.

To reset the clock, from the Main Menu select "Configure", then Set Clock. Enter the correct time to +/- 1 minute from true. Enter the corrected time on your calibration data sheet.

BGI Annual Cal
Annual Multipoint Verifications / Calibrations

Site Name ____________ Date ____________
Site No. ____________ Technician ____________
Instrument No. ____________

Test Equipment

	Make/Model	ID	cal date	correction factor
Flow rate std				
Temp std				
Pressure std				

Multipoint Verification

	low pt		mid pt		high pt	
	sampler	thermo	sampler	thermo	sampler	thermo
Ambient Temp						
Filter Temp						

Temperature and Pressure Calibration

	As-Is			Final			limits
	Indicated	Standard	Offset	Indicated	Standard	Offset	
Amb. Temp							2 C
Filt. Temp							2 C
Amb Press							10 mm
Filt. Comp. Temp							2 C
Amb Rel Humidity							1.5%

Ext Leak Check: Initial: ________ Final: ________
Int. Leak Check: Initial: ________ Final: ________

Multipoint Flow Calibration

	Sampler Indicated	Standard " H20	Standard Actual	% dif
As-Is Flow Check:				

	Set Point lpm	Current lpm	FTS in H2o	Actual lpm
1	16.67			
2	16.67			
3	16.67			

Offset: ____________
Span: ____________

Sampler/Standard
Amb. Temp : ____________
Amb. Press : ____________

	Sampler Indicated	Standard " H20	Standard Actual	% dif
Final Flow Check:				

Calibrated By: ____________

BGI Annual Cal 09/03 CL

Figure E-1.2.1.1 BGI PQ200 Annual Verification/Calibration Form

GREAT BASIN UNIFIED
AIR POLLUTION CONTROL DISTRICT

AIR MONITORING QUALITY ASSURANCE

APPENDIX E-2

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

RUPPRECHT & PATASHNICK
PARTISOL-PLUS MODEL 2025 PM10 AIR SAMPLER

December 2012

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APPENDIX E-2

RUPPRECHT & PATASHNICK PARTISOL-PLUS MODEL 2025 PM-10 AIR SAMPLER

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APPENDIX E-2

RUPPRECHT & PATASHNICK PARTISOL-PLUS MODEL 2025 PM-10 AIR SAMPLER

TABLE OF CONTENTS (cont'd)

FIGURES

E-2.1.0 GENERAL INFORMATION

E-2.1.0.1 Purpose

The purpose of these Standard Operating Procedures (SOP) is to supplement the manufacturer's Operator's Manual by describing modifications in hardware or procedures which may have been implemented by the Monitoring and Laboratory Division of the Air Resources Board. These modifications are designed to assure compliance with the Federal Reference Method for collection of particulate matter 10 microns or smaller (PM10) when using the Rupprecht & Patashnick (R&P) Partisol-Plus Model 2025 PM10 Air Sampler.

E-2.1.0.2 General Description and Theory of Operation

Read Section 1 of the R&P Operating Manual and see Figure E-2.1.1, Sequential Partisol Schematic.

E-2.1.0.3 Safety

Installation, operation, maintenance, or calibration of the sampler should only be performed by properly trained personnel. High (120 volts A.C.) voltages are used to power the unit and due to typical rooftop installations, the risks of working outdoors at elevation should also be considered.

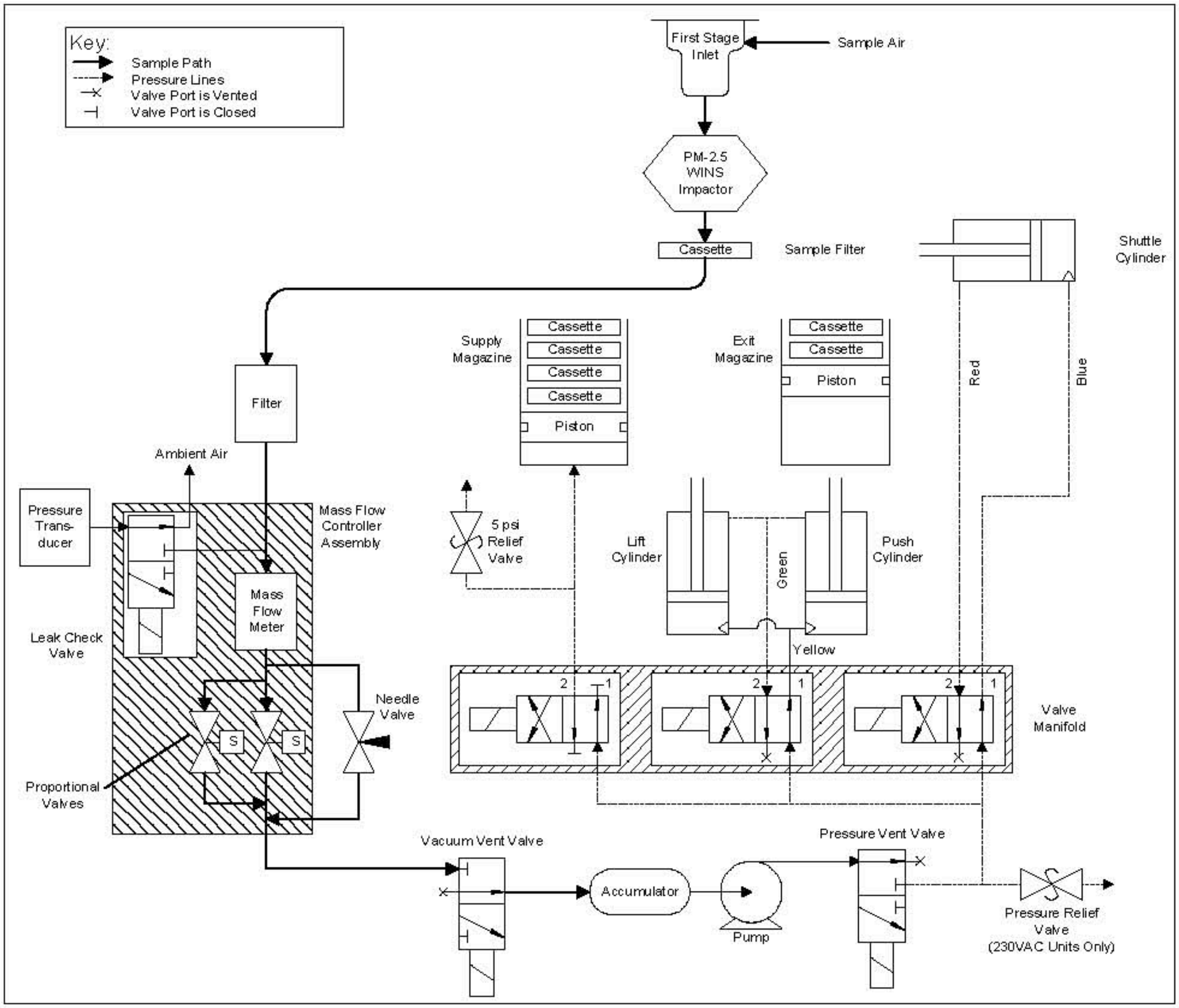

Figure E-2.1.1 Sequential Partisol Schematic

E-2.1.1 INSTALLATION PROCEDURE

E-2.1.1.1 Physical Inspection

Each R&P Partisol-FRM Model 2025 PM10 Air Sampler by the District should be supplied with the following items:

1 Partisol-Plus enclosure with filter exchange mechanism
1 Inlet system for size-selective sampling
1 sample tube
1 Partisol-Plus stand
3 rain hoods and associated hardware
1 flow audit adapter
3 magazine transport container with cassettes and carriers
1 ambient temperature sensor and cable
3 filter cassette magazines
2 sets of inlet O-rings
1 analog input calibration cable
1 mating cable connector for four-pin user output connector
1 Operating software diskette
1 9-to-9 pin computer cable
2 Operating Manuals
1 Service Manual
1 Quick Start Guide

Upon receipt of the sampler(s), inspect sampler and accessories for shortage and for shipping damage. If shortage or damage is found, immediately notify your supervisor, and/or your agency's shipping department.

E-2.1.1.2 Initial Sampler Installation

Follow directions found in Section 2 of the R&P Operating Manual for installation instructions and consult with your area specialist/engineer or supervisor to assure that installation site complies with Federal and State siting criteria for FRM PM10.

E-2.1.1.3 Initial Sampler Set-Up

Follow directions found in Sections 4, 5, and 6 of the R&P Operating Manual.

E-2.1.2 ROUTINE SERVICE CHECKS

E-2.1.2.1 General Information
Activities are to be documented on the Quality Control/Maintenance Check Sheet/Log, Figure E-2.1.2.1.1

E-2.1.2.2 Daily Checks
- Status 'OK'
- Check time, date, & start time
- Mode 'Wait', 'Samp', or 'Done' depending on sampling condition

E-2.1.2.3 Weekly Checks
- Sample run times & flows OK

For samplers on daily sampling schedule:
- Clean or exchange PM10 inlet & water trap
- Inspect V seals and clean as needed.
- Inspect interior of sampler

E-2.1.2.4 Biweekly Checks
For samplers on daily sampling schedule:
- Download filter data
- Collect exposed filters
- Install new filters and update sampling schedule

E-2.1.2.5 Monthly Checks
- Clean or exchange PM10 inlet & water trap
- Inspect V seals and clean as needed.
- Clean sampler case
- Clean downtube
- Inspect & service air intake fans & filters
- Perform sampling verification tests – Flow rate, temperature, pressure, & leak checks
- Document activities on Partisol Flow Check Form, Figure E-2.2.0.4.1
- Download filter data

E-2.1.2.6 Quarterly Checks
- Inspect & service downtube & case seals
- Inspect & service pump and tubing connections
- Inspect & service electrical components & connections
- QA performance audit conducted by District auditor

E-2.1.2.7 Semiannual Checks
- Exchange particle trap filter
- Clean & service air intake fans & filters
- Test batteries – 3 'AA'
- Perform pump test

E-2.1.2.8 Annual Checks
- Replace O-rings & V-seals

- Perform instrument calibrations
  - Analog input/output
  - Pressure sensor
  - Relative humidity
  - Ambient temperature sensor – 3 pt.
  - Filter temperature sensor – 3 pt.
  - Flow rate – 3 pt.
- Document all activities on the Partisol 2025 Annual Multipoint Verifications/Calibrations form,

E-2.1.3 MAINTENANCE PROCEDURES

E-2.1.3.1 General Information

Read the operator's manual for more detailed information regarding sampler maintenance.

E-2.1.3.2 Sampler Maintenance

The sampler should be wiped down with a clean wet cloth when required. Clean the filter compartment with a wet cloth when required. Clean the sampler downtube as necessary; quarterly at minimum. Check "V" seals and replace when necessary. See operators manual, section 3.1.5. "Inspect V Seals" for more information.

E-2.1.3.3 PM10 Inlet Maintenance

Clean the PM10 inlet as necessary: weekly for Owens Lake network sites; monthly at all other sites, at a minimum. Refer to section G.1. in the operators manual for specific instructions.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT
Quality Control - Maintenance Check Sheet / Log
PARTISOL 2025 – PM_{10}

Station Name: ______________________________ Month / Year: ______________________
Station Number: ______________________________ Technician: ______________________
Property Number: ______________________________ Serial Number: ______________________
Site Elevation: ______________________________
Last Cal. Date: __________________ Last Cal. Flow / Δ% : ______________________________

WEEKLY	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time
PM10 Inlet					
Visual Inspection of O-Rings (Inlet/Impactor)					
Inspect interior of sampler					
Inlet Prop. No.					

BI- WEEKLY	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time
Download Data File # __________					
Install New Filters _______Sample _______Blank(s)					

MONTHLY	Date/Time
Sampling Verification Tests: Temperatures (1 pt), Pressure, Internal Leak Check, External Leak Check, Flow Rate (1 pt), Clock	
Clean interior of sampler case. Inspect/service cooling air intake filter & fans.	
Clean PM_{10} inlet, downtube and WINS impactor. Inspect/Clean V-Seals: Replace if necessary.	

QUARTERLY	Date/Time
Inspect particle trap filter	
Inspect/service water seal gasket (downtube to sampler case)	
Inspect/service vacuum tube fittings, pump connections, electrical components	

Partisol 2025 Maintenance 1.0
09/05/01 – PM 2.5
Page 1 of 2 (sno)

Figure E-2.1.2.1.1 Monthly Quality Control Maintenance Check Sheet, Page 1

QA: Sampler performance audits* [Temps, pressure, flow rate, leak check] *Criteria: Temperature ±2°C / Pressure ±10mm Hg / Flow Rate ±4% , Warning ±10% Invalidation or Correction	

6 MONTHS			Date/Time
Exchange particle trap filter			
Test batteries ______________ VDC			
Inspect filter exchange mechanism parts (Check cassette push rod for rust)			
Rainhoods: Clean air screens			
Conduct pump test >	Press: __________psi	Vac ___________"Hg	

ANNUALLY	Date/Time
Replace O-Ring (inlet) and V-Seals	
Exchange batteries	
Inspect & replace if needed all outside parts (hinges, handles, latches) for weathering/wear, cracks, rust	
Calibration:	
• Ambient temperature multipoint verification	
• Ambient filter temperature multipoint verification	
• Ambient pressure [multipoint ?] calibration	
• Flow rate multipoint verification	
• Flow rate [single ?] verification	
• Ambient relative humidity	
• External leak check	
• Flow controller	
• Analog I/O (automatic)	

18 MONTHS	Date/Time
Rebuild or replace pump	

WHEN OUT OF SPECIFICATIONS (Otherwise at installation & annually)	Date/Time
Ambient temperature multipoint verification and/or calibration	
Filter temperature multipoint verification and/or calibration	
Pressure calibration (multipoint)	
Flow rate multipoint verification and/or calibration	

Comments:
____
____
____

Reviewed By: ________________________ Date: _____________

Partisol 2025 Maintenance 1.0
09/05/01 – PM 2.5
Page 2 of 2 (sno)

Figure E-2.1.2.1.1 Monthly Quality Control Maintenance Check Sheet, Page 2

Figure E-2.1.2.1.2 Annual Multipoint Verifications/Calibrations Form

Partisol 2025
Annual Multipoint Verifications / Calibrations

Site Name ____________________ Date ____________________
Site No. ____________________ Technician ____________________
Instrument No. ____________________

Test Equipment

	Make/Model	ID	cal date	correction factor
Flow rate std				
Temp std				
Pressure std				

Multipoint Verification

	low pt		mid pt		high pt	
	sampler	thermo	sampler	thermo	sampler	thermo
Ambient Temp						
Filter Temp						

Temperature and Pressure Calibration

	As-Is			Final			limits
	Indicated	Standard	Offset	Indicated	Standard	Offset	
Amb. Temp							2 C
Filt. Temp							2 C
Amb Press							10 mm
Filt. Comp. Temp							2 C
Amb Rel Humidity							1.5%

Ext Leak Check: ____________________

Multipoint Flow Calibration

	Sampler Indicated	Standard " H20	Standard Actual	% dif
As-Is Flow Check:				

	Set Point lpm	Current lpm	FTS in H2o	Actual lpm
1	15.00			
2	16.67			
3	18.40			

Amb. Temp : ____________________
Amb. Press : ____________________

Offset: ____________________
Span: ____________________

	Sampler Indicated	Standard " H20	Standard Actual	% dif
Final Flow Check:				

Calibrated By: ______________________________

2025 Annual Cal DRAFT 10/01 GD

E-2.1.4 SAMPLE FILTER HANDLING PROCEDURES

E-2.1.4.1 General Information

Federal regulations stipulate specific time frames and environmental conditions for FRM PM10 sample filters at various stages in the sampling program. If these time frames and conditions are not met, sample filters may be flagged or invalidated by the receiving laboratory. In addition to these requirements, operators should practice the usual care to prevent or minimize contamination of the sample filters, filter cassettes, or anything else which may come in contact with the sample filters.

E-2.1.4.2 Presampling Filter Handling Procedures

Sample filters must be retained in their magazine prior to sampling to ensure that any possible contamination is prevented.

E-2.1.4.3 Postsampling Filter Handling Procedures

Sampled filters must be removed from the sampler and the magazine placed in its transport holder until it is transported to the laboratory. The transport holder should be kept in the upright position.

Sampled filters will be transported to the laboratory biweekly.

E-2.1.4.4 Filter Blank Handling Procedures

Filter blanks are delivered to the field in the filter cassette magazines, just the same as the filters to be sampled, the exception being that they will not be used to collect samples. Blanks are to be noted in the filter list so they will be shuttled through the sampler without collecting a 24-hour sample. They are stored in the filter cassette magazine along with the sampled filters and are handled just the same. Blanks are noted on the PM10 Sequentials Custody Report (Figure E-2.1.4.3.1) and submitted with the rest of the sampled filters.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT
PM10 SEQUENTIALS CUSTODY REPORT

Site Name: ______________________
Site ID: ______________________
Sampler ID: ______________________
Transport to Field: ________ / ________ (Initial / Date)
Received in Field: ________ / ________ (Initial / Date)

INSTALL

Operator: ______________
Canister Install Date: ______________
Canister Install Time: ______________

REMOVE

Operator: ______________
Canister Remove Date: ______________
Canister Remove Time: ______________
Data Dumped to Disk?: ______________

Install Filt Sequence ↓ / Remove Filt Sequence ↑

	Filter #	Cassette #	Run Date	Laboratory use only: Confirm Filter Sequence
Current Filter in Sampler:				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

Operator Comments: ______________________________

Transport from Field: ________ / ________ (Initial / Date)

LABORATORY INFORMATION

Lab Prep Date: ______________
Prepared by: ______________
Comments: ______________

Date Rec'd in Lab: ______________
Received by: ______________
Comments: ______________

Sequential Data Sheet 1.2 3/03

Figure E-2.1.4.3. GBUAPCD PM10 Sequentials Custody Report

E-2.1.5 TROUBLESHOOTING

E-2.1.5.1 General Information

If review of the R&P Operating Manual does not result in correction of the problem, notify your area engineer, specialist, and/or repair facility technician.

GREAT BASIN UNIFIED
AIR POLLUTION CONTROL DISTRICT

AIR MONITORING QUALITY ASSURANCE

APPENDIX E-2.2

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

CALIBRATION PROCEDURES FOR R&P PARTISOL-PLUS MODEL 2025 PM10 AIR SAMPLER

DECEMBER 2012

E-2.2.0 BACKGROUND AND GENERAL INFORMATION

E-2.2.0.1 Introduction

This SOP for the Rupprecht & Patashnick Partisol- Plus Model 2025 PM10 Air Sampler (R&P PM10 FEM) is written as a starting point only. The procedures listed are in reference to the R&P Operating Manual and are in the process of being tested or tried. This document is for preliminary purposes only and will likely change as the monitoring program continues.

E-2.2.0.2 Overview

The calibration of the particulate matter samplers whose mass has an aerometric diameter of less than 10 microns (PM10) must be performed on an annual basis. There are several parameters that must be calibrated with this new generation of fine particulate matter samplers. These parameters include flow or volume, temperature, pressure and time. The GBUAPCD has chosen three reference method samplers to monitor for PM10 at this time. These samplers are the BGI PQ200 Air Sampler, the R&P Partisol-Plus 2025 sequential sampler and the R&P Partisol FRM 2000 sampler. Each sampler has a different principle of flow and, therefore, two calibrations are required for this SOP. The following procedures concentrate on the R&P PM10 FRMs.

The calibration procedure in Section 12 of the R&P Operating Manual is fairly complete, accurate and easy to follow. The primary purpose of the calibration is to determine and/or verify that the volumetric flow of the PM10 sampler is at 16.67 liters per minute (LPM), or that the sampler collects a volume of 1 cubic meter of air per hour. Refer to 40 CFR Part 50, Appendices J and M for further information.

E-2.2.0.3 Apparatus for R&P PM10 Sequential Sampler Calibration

1. NIST-traceable mass flow transfer standard
2. NIST-traceable temperature sensor
3. NIST-traceable pressure sensor
4. R&P inlet flow adaptor
5. tubing
6. blank filter
7. calibration forms or laptop computer
8. Leak check disk

E-2.2.0.4 General Information

The calibration of the R&P PM10 FRM sampler should be performed in the following steps:

1) temperature calibration
2) pressure calibration
3) leak test
4) flow calibration
5) verify calibration parameters

All calibration information and data will be recorded on the Partisol Flow Check Data Sheet (Figure E-2.2.0.4.1).

Great Basin Unified Air Pollution Control District

Partisol Flow Check

Date:			Site Name:				
Start:		PST	Site #:				
Finish:		PST	Operator:				
			Project:				
Make:	R&P		Site Elevation:		ft		
Model:	2000 / 2025	*(circle one)*	Amb. Press.:		"Hg	/29.92=	Atm
Prop. # / Ser. #:	/		Amb. Temp.:		°C	+273=	°K
Type:	PM_{10} / $PM_{2.5}$	*(circle one)*					
Last Cal. Date:							

	Audit Device
Make:	Chinook Eng.
Model:	Streamline FTS
S/N:	
Range:	
Calibration factors:	
m:	
b:	
Cal date:	

$Q_a=m[dPxT_a/P_a]^{1/2}+b$

Verify	Sampler		Standard		(Raw)	Diff.
Filter Temp		°C		°C		
Amb Temp		°C		°C		
Amb Press		mm		mm		
Date						
Time		PST		PST		

Leak Check	Initial Pres.	Final Pres.	P_i-P_f	$Limit_{2025}$	$Limit_{2000}$
External				<25mm	<17"/min
Internal				<140mm	<17"/min

Flow Check	Audit Flow		Ind. Flow	Diff. *	Nominal Flow Limit †	
	delta P	(VLPM)	(VLPM)	(%)	(LPM)	(LPM)
Total Fow Rate					15.9	17.5

For PM2.5 : ** Ind. Flow < 4% difference from verification flow*
† Audit flow < 5% difference from design flow (16.7 lpm)

For PM10 : ** Ind. Flow < 7% difference from verification flow*
† Audit flow < 10% difference from design flow (16.7 lpm)

Comments:

Calibrated by: Reviewed by:

Partisol Monthly Verification Form 2.0 - 5/2001

Figure E-2.2.0.4.1
R&P PM10 Partisol-Plus Sequential Sampler Calibration Data Sheet

GREAT BASIN UNIFIED
AIR POLLUTION CONTROL DISTRICT

AIR MONITORING QUALITY ASSURANCE

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

APPENDIX E-3

ACCEPTANCE TESTING
FOR
FRM PARTICULATE MATTER 10 MICRON (PM10) SAMPLERS

DECEMBER 2012

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APPENDIX E.3

ACCEPTANCE TESTING FOR FRM PARTICULATE MATTER 10 MICRON (PM10) SAMPLERS

FIGURES

E.3.1.0 ACCEPTANCE TEST PROCEDURE

E.3.1.0.1 General Information

Federal Reference Method samplers for sampling of particulates of 10 microns and smaller (FRM 10) will be acceptance tested by the technical staff of the Great Basin Unified APCD and/or the Air Resources Board (ARB) Monitoring and Laboratory Division (MLD). Samplers may be supplied by various manufacturers. Samplers may be of a single filter, manual operation design, or may be of a sequential design utilizing rotating filter holder trays or filter cartridge magazines. Before beginning acceptance testing of the samplers, read the operator's manual supplied with each sampler.

Initiate an acceptance test log and an acceptance test mini-report (Figure E.1.0.1.1) for each sampler. Record the dates of the individual test, problems, contacts with the manufacturer, and any other pertinent information on the acceptance test log.

E.3.1.0.2 Physical Inspection

Unpack the sampler and check for physical damage if this has not already been done. Verify that the sampler is complete and includes two service manuals and all options and parts required by the purchase order. Refer to the packing list as necessary. Note any broken or missing parts.

Open access doors, or remove panels or covers as applicable to each individual model of sampler to make the following checks:

1. Verify that the cabinet and all connnections are weatherproof. Visually inspect the gaskets and seals for pin holes and/or damage.

2. Make sure that all circuit boards are properly seated in their connectors by removing and reinserting each board.

3. Check for correct power cord phasing; standard wiring configuration has the black wire connected to the brass terminal of the plug, white to the copper terminal, and green to earth ground.

4. Completely assemble the sampler; including the inlet head, and analyzer accessories following the procedures in the manufacturer's manual. Verify that the cabinet support structure is capable of keeping the sampler secure, steady and upright.

ACCEPTANCE TEST DATA SHEETS
FRM 10 SAMPLER

Manufacturer_______________________________Model ________________Serial No________________
Type: Sequential Multi-Channel _____ Single Channel ______

Testing performed by_______________________ Date Test Initiated ________________
Test data reviewed by_______________________ Date Accepted __________________

PHYSICAL INSPECTION				
	DATE			
	Completed	Passed	Failed	Final OK
Shipping Damage				
Two operator manuals				
Power cable phasing				
Internal Wiring				
Switch, lamps, controls				
PC board(s) seated				
Assembly				
OPERATIONAL TESTING				
Programming				
Power Failure / Memory				
Leak Check Test				
Calibrate Sample Flowrate				
Filter exchange mechanism				
Operation test "run"				
Data download				
ENVIRONMENTAL CHAMBER TEST				
16 Hour test run				
Flowrate Stability				
Temperature				

Comments, and corrections of failures: ____
____

Figure E.3.1.0.1.1
Acceptance Test Data Sheets

E.3.1.0.3 Operational Checks

When the FRM PM10 sampler is completely assembled initate operational testing as outlined below. Record the results of each test on the acceptance test data report for each sampler.

1. Basic Operation

   Apply electrical power to the sampler (120 vac @ 60Hz) and turn on the sampler. Verify that all switches and controls, the internal fan and sampler delivery motor operate properly.

2. Programming:

   Program the sampler using the keypad and display. Verify programming and operation of the sampler by automatically initiating and terminating a short operational sample run.

3. Power failure / memory test:

   Interrupt power to the sampler for 3 to 5 minutes. Verify that the sampler restarts, maintains memory, and continues to operate properly after power is resored.

4. Leak check test:

   Perform a leak check on the sample train per the manufacturer's operator's manual. Verify the system's integrity.

5. Flowrate control / calibration:

   Adjust, set or calibrate the sample flowrate through the sampler using a certified mass flow meter (MFM) of the proper range or the calibration apparatus supplied by the manufacturer.

6. a. Filter exchange mechanism test (sequential multi-channel samplers):
   Operate the automatic channel/filter change mechanism for each channel to verify smooth and proper operation.

   b. Filter holder mechanism (single channel sampler):
   Install a filter into the holder apparatus to ensure proper operation of the mechanism and to check for proper sealing of the gasket(s).

7. Operational test run:

   Program the sampler to perform a complete sample "run" for at least four hours.

8. Data download test:

   Connect a laptop (or equivalent) computer or data recovery link provided by the manufacturer to the RS-232 communications port on the sampler and download the operational data resulting from the operational test run (#6 above). Print the data and attach it to the sample report form.

E.3.1.0.4 In Situ Temperature and Voltage Stability Tests

Install the FRM PM10 sampler at the sampling site or in a comparable setting. Connect a certified MFM to the sample inlet of the FRM PM10 sampler under test. Place the MFM near the sampler to measure and record the sample flowrate through the sampler.

Place a thermocouple in the filter holder in FRM PM10 sampler and bring the thermocouple leads outside the sampler housing to measure and record the temperature at the sample filter.

Program the FRM PM10 sampler to operate continuously during this test.

Enter the test results on the acceptance test data sheet and label the forms with the date of test, Manufacturer, Model and Serial Number of the sampler, parameter identification, temperature and voltage data. Clear, precise notations should be entered on the forms indicating when the tests were started and ended, pertinent information regarding sample flow, voltages, temperatures, and any unusual conditions observed. Any additional pertinent information should be attached to the final acceptance reports.

Verify that the FRM PM10 sampler operates properly with no malfunctions during and after the field testing.

E.3.1.0.5 Post Acceptance Test Documentation:

Review and assemble all acceptance test data and documentation and submit it to the designated acceptance test data reviewer. After the review of the data are complete and approved, the FRM PM10 sampler will be delivered to the monitoring site for installation.

Great Basin Unified Air Pollution Control District
Standard Operating Procedure
For Air Quality Monitoring
Appendix E-4

Rupprecht & Patashnick Series 1400a(AB) TEOM PM10 Continuous Monitor

December 2012

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APPENDIX E-4

STANDARD OPERATING PROCEDURE
FOR AIR QUALITY MONITORING
RUPPRECHT & PATASHNICK SERIES 1400a(AB) TEOM CONTINUOUS PM10 MONITOR

		PAGES	REVISION	DATE
E-4	**ACCEPTANCE TEST PROCEDURE**	20	2	12/21/2012

FIGURES

E-4.1.0 GENERAL INFORMATION

E-4.1.0.1 PURPOSE

These procedures are intended to supplement the Rupprecht & Patashnick (R&P) Model 1400a Tapered Element Oscillating Microbalance (TEOM) Operating Manual (R&P Manual). They will direct the user to appropriate sections of the R&P Manual and describe modifications in hardware or procedures which may have been implemented by the Great Basin Unified Air Pollution Control District (District). It is recommended that the R&P Manual be utilized in conjunction with these written procedures during installation, operation, or calibration.

E-4.1.0.2 GENERAL DESCRIPTION

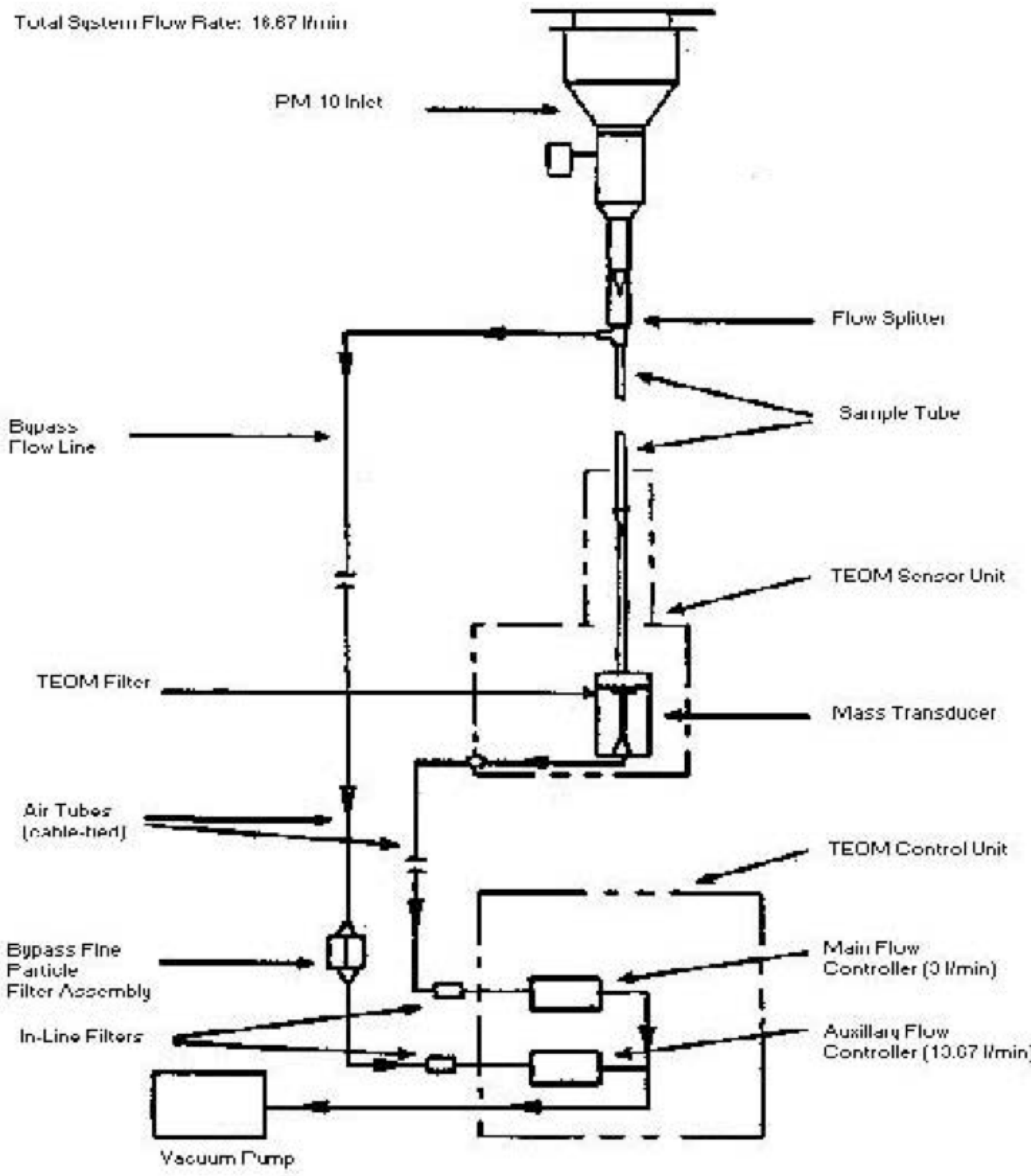
In October 1990, the United States Environmental Protection Agency (U.S. EPA) designated the R&P TEOM as an equivalent method for the determination of 24-hour average PM10 concentrations (EQPM-1090-079). The TEOM continuously monitors PM10 levels by capturing particulate on a sample filter attached to a vibrating inertial mass transducer. Using the rate of mass accumulation on the filter and the flowrate through the sample (main) flow controller, the TEOM's microprocessor calculates the mass concentration. The flowrate through the sample filter is set at a nominal 3.0 liters per minute (LPM). A bypass (auxiliary) flow is used to provide an additional 13.67 LPM for a total flowrate of 16.67 LPM, the design flow of the size selective inlet. A schematic diagram of the TEOM's flow system is shown in Figure E-4.1.0.2. Additional information on its operation is contained in Section 1 of the R&P Manual.

There is currently one model of TEOM in use by the District: the Series 1400a(AB). The 1400a has selectable output voltages of 0 to 1, 2, 5, and 10 volts direct current (vdc).

E-4.1.0.3 SAFETY

Installation, operation or calibration of these instruments should only be attempted by properly trained personnel. High voltages may be present in the TEOM sensor and control unit enclosures.

Figure E-4.1.0.2 TEOM Flow Diagram



E-4.1.1 INSTALLATION PROCEDURE

E-4.1.1.1 COMPONENTS

The TEOM consists of two main components, the electronics control and sensor units. Additional components supplied by R&P are listed on Page 2-3 of the R&P Manual. Typical ARB installations should also include the following items in addition to those listed in the R&P Manual:

1. An additional PM10 inlet (R&P or Sierra-Andersen Model 246b).

2. A sufficient length of internally polished, to 15 micro-inch roughness, 1/2 inch OD stainless steel (ss) tubing (Valex Corporation Type 3-16LS, MO #159137-01 or equivalent) for a one-piece sample probe.

3. A heavy-duty, photographic type tripod for support of inlet or other bracing.

4. A sufficient length of 3/8" OD x 1/4" ID flexible tubing for remote vacuum pump installations. Larger ID heavy-wall tubing is recommended for runs longer than 50 feet.

5. Additional sample, inline and auxiliary flow filters.

6. TEOM Quality Control – Maintenance Check Sheet/Log (Figure E-4.1.1.1).

E-4.1.1.2 INSTALLATION

The System Installation directions in Section 2 of the R&P Manual should be followed as closely as possible. Two factors of primary concern that will determine the placement of the sensor unit are the need for a sturdy, vibration free mounting and a straight vertical access to the roof for the sample probe. Installations for mounting of the sensor (see Figure E-4.1.1.2) may include counter-tops, reinforced wall shelves or vibration isolated instrument rack shelves. The sample probe and auxiliary flow lines should be run in a 2 to 3 inch ID heavy-wall, sunlight resistant PVC conduit which starts flush with the interior ceiling and ends 30 inches above roof level. Seal the roof/conduit juncture with a roof jack equipped with a vinyl collar. Install a PVC cap on the outside end of the conduit to prevent rain entry. The cap will need to be drilled with one ½-inch hole on center for the probe and one 3/8ths inch hole off center for the auxiliary flow line. This should provide a sturdy, rain tight mounting for the tripod, flow splitter and inlet. Insulate the sample probe between the sensor housing and the exterior roof with foam pipe insulation. This will minimize temperature fluctuations caused by air conditioning drafts.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT
Quality Control - Maintenance Check Sheet / Log
TEOM 1400a (AB Serial) – PM_{10}

Station Name: ________________ **Station Number:** ______________ **Month / Year:** ______________
Serial Number: _________ **Technician:** __________________

WEEKLY CHECK					
Name					
Date					
Time (PST)					
Status					
Operating Mode					
% of Filter					
Inst Mass Conc. µg/m³					
30 Minute MC					
1 Hour MC					
24 Hour MC					
Total Mass µg					
Case Temperature °C					
Air Temperature °C					
Cap Temperature °C					
Main Flow lpm					
Auxiliary Flow lpm					
Noise					
Frequency					
Clean Inlet X=Exchange / C=Clean					

BI-WEEKLY PRECISION CHECK														
		TEOM INDICATED					AUDIT DEVICE							
DATE	START/STOP	MAIN	AUX	TOTAL	PRESS	TEMP.	MAIN	MAIN	DIFF.	TOTAL	TOTAL	DIFF.	PRESS	TEMP.
	TIME (PST)	lpm	lpm	lpm	atm	° C	Ind.	lpm	%	Ind.	lpm	%	atm	° C
Indicated main & total flow <7% difference from audit flow and <10% difference from design flow, 16.7 lpm (15.0 lpm – 18.4 lpm)														

Flow Device: Make - Chinook Model - Streamline FTS Serial #______ Serial # _______

DATE	Comments or Maintenance Performed

TEOM 1400a (AB Serial) Maintenance Log 6.2 – PM10
12/21/2012 - Page 1 of 2

TEOM Quality Control – Maintenance Check Sheet/Log, Page 1 (Figure E-4.1.1.1)

MAINTENANCE SCHEDULE **[Note: All 'TIME' is PST.]**

ALL BLANKS ARE TO BE COMPLETED

A. EACH VISIT [ ] Check Status Light, Percent of Filter (Record Weekly).

B. WEEKLY [ ] Record Indicated Values (Digital Display)
[ ] Clean TEOM PM_{10} Inlet.
[ ] O-ring visual inspection.

C. BI-WEEKLY [ ] Perform Precision Check. If % difference of flow rate is >7% from expected value, notify supervisor.

D. MONTHLY* [ ] Exchange TEOM (sample) filter and F1 Reset.
*Sooner if needed and before reaches Total Mass 3,000µg or % of Filter reaches 90%.
Date: ____________ Time: _______
Date: ____________ Time: _______
Date: ____________ Time: _______
[ ] Check all in-line filters (replace if needed) & lines.
[ ] Data download. Pointer Loc.: ____________ Date: ____________ Time: _______

E. QUARTERLY [ ] Perform Quality Control check.
Check Total, Main, Auxiliary Flow rates.
Conduct leak check. Date: ____________ Time: _______
Verify ambient pressure & ambient temperature.
→Note: Document also on TEOM Calibration Form.
[ ] Quality Assurance Flow Audit. Date: ____________ Time: _______

F. SEMI-ANNUAL [ ] Clean air inlet system. [Down tube & auxiliary line.] Date: ____________ Time: _______
[ ] Replace main [sample] and bypass [aux] flow in-line filters. Date: __________ Time: _______
[ ] Pump vacuum. Conduct pump test: VAC _____" Hg Date: ____________ Time: _______

G. ANNUALLY [ ] Replace Inlet O-rings. Date: ____________ Time: _______
[ ] Analog In/Out calibration Date: ____________ Time: _______
[ ] Ambient pressure & temperature sensor calibration. Date: ____________ Time: _______
[ ] Flow controller calibration (hardware). Date: ____________ Time: _______
[ ] Mass transducer calibration verification. Date: ____________ Time: _______

H. 18 MONTHS [ ] Replace sample pump. Date: ____________ Time: _______
THREE YEARS [ ] Replace onboard battery Date: ____________ Time: _______

I. AS NEEDED [ ] Flow controller calibration (software) [As Is & Final]. Date: ____________ Time: _______
F_{adj} Main _____ F_{adj} Aux _____

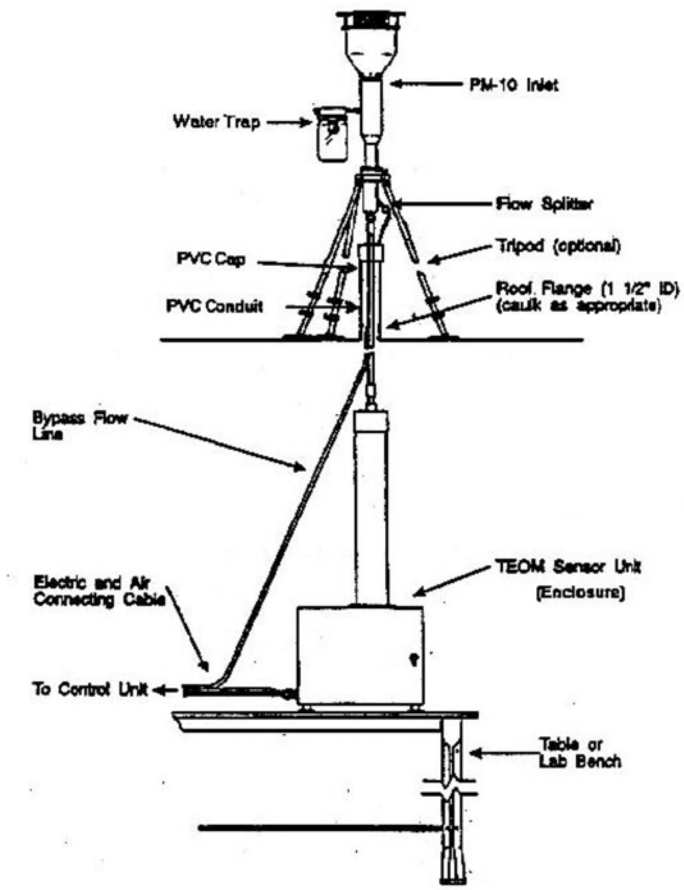
Outdoor Enclosure
☐ [ ] Air Conditioner: Condenser air inlet > clean filter
☐ [ ] Screen on back of pump box > clean.

Reviewed By: ______________________ Date: ____________

TEOM 1400a (AB Serial) Maintenance Log 6.2 – PM10
12/21/2012 - Page 2 of 2

TEOM Quality Control – Maintenance Check Sheet/Log, Page 2 (Figure E-4.1.1.1)

Figure E-4.1.1.2 Installation Diagram



E-4.1.1.3 SOFTWARE CONFIGURATION

The software configuration consists of setting various parameters in the TEOM's software such as choice of analog outputs, temperatures, pressures, and flow rates. These procedures are detailed in Sections 4 and 5 of the R&P Manual.

Typical District installations have settings that may differ from examples shown in the R&P Manual. The following settings are currently being used at District monitoring sites:

NOTE: If the TEOM is shut off, an internal battery will hold the configured settings.

SET ANALOG OUTPUTS (Menu Screen 04); see page 5-3 of R&P Manual

Max Volt 1-VDC - Sets Output Range Voltage to 0-5.0 VDC

A01 Var Mass Conc - Selects Mass Conc. as output of A01

AO1 Min 0.00 - Selects 0 as Minimum Mass Concentration

AO1 Max 10000.00 - Selects 10,000 as Maximum Mass Concentration

Jumpers 2-VDC - Reflects Internal Jumper Connections

These settings correspond to an output slope of 1000 and an intercept of -50. The purpose of this offset is to minimize negative voltage outputs if the TEOM's mass concentration readings fall below zero. This offset must be considered when connecting the TEOM to an external recording device such as a chart recorder or data logger.

SET TEMPS/FLOWS (Menu Screen 12); see page 4-19 of R&P Manual

The settings shown on Screen 12 of the R&P Manual are correct for most applications, however, in 1993-1994, the U.S. EPA granted conditional approval for modifications to the main flowrate and temperature settings under provisions contained in Section 2.8 of Appendix C to 40 CFR part 58.

The flowrate modification consists of operating the TEOM at the reduced main (sample) flowrate of either 1.0 or 2.0 LPM if it is equipped with the proper flow splitter (available from R&P). The reduced flowrate provides an extended interval between sample filter changes in areas of high particulate concentrations. Unfortunately, utilizing the reduced main flow option renders the percent filter load indicator inoperable and operators must depend on scheduled filter changes only rather than on a measure of the loading/pressure drop.

The temperature modification consists of operating the TEOM at the reduced temperatures of: CaseT 30, AirT 30, CapT 0 (off), and EnclT 25 degrees Centigrade (C). This modification is intended to reduce volatilization of the sample and thus provide better correlation of the data with conventional gravimetric PM10 measurement methods. This temperature configuration is only permitted if certain conditions exist and with approval by the U.S. EPA on a case-by-case basis. For more information, see R&P's Technical Note #4, dated October 1993.

T-A/S 99.00 25.00
These are the ambient (outdoor) and-reference standard temperature settings, left to right respectively. The ambient temperature is measured by and external sensor mounted on the TEOM flow splitter. Setting the ambient temperature at 99.00 triggers the TEOM to use the temperature measurement from its ambient sensor. The standard temperature setting should be set at 25 degrees C, the U.S. EPA standard temperature to which the flowrates and mass concentration calculations are referenced.

P-A/S 9.000 1.000
These are the average and standard barometric pressure settings, left to right respectively. The average pressure setting should be set to the barometric pressure in atmospheres (atm) of 9.000 in order to trigger the TEOM to use the ambient pressure as measured with its internal sensor to calculate flowrates and PM concentrations.

The standard pressure setting should be set to 1.000 atm. This is the U.S. EPA standard pressure to which the flowrates are referenced.

Fadj Main 1.000 and FAdj Aux 1.000

These factors are used by the TEOM's software to adjust for deviations of the main and auxiliary flowrate setpoints from the actual flowrates. They are determined by a proportional comparison to the actual or true flowrates as measured with a transfer standard during the software calibration. Additional information on these factors is contained in Section 8.2 of the R&P Manual.

E-4.1.2 QUALITY CONTROL MAINTENANCE CHECKS

E-4.1.2.1 GENERAL INFORMATION
Detailed directions of routine maintenance procedures are described in Section 7 of the R&P Manual. Based upon these manufacturer's procedures and U.S. EPA requirements, the TEOM Quality Control – Maintenance Check Sheet/Log, shown in Figure E-4.1.1.1, has been developed to alert the operator that maintenance is due and to provide a record of quality control actions.

E-4.1.2.2 DAILY CHECK
On a weekly (at minimum) basis, the TEOM's operation should be checked by viewing the Status Light, Percent of Filter display and flag indicator. The red Status Light will turn on if a monitored parameter such as temperatures, pressures, or flowrates are out of operational bounds. See Page 4-4 of the R&P Manual for additional details. The TEOM's sample filter should be changed before 90% is indicated on the display, or monthly, at a minimum. Procedures for changing the filter are in Section 3 of the R&P Manual.

E-4.1.2.3 WEEKLY CHECK
On a weekly basis, record the values found on the Main Screen of the TEOM's digital display onto the TEOM Quality Control – Maintenance Check Sheet/Log, shown in Figure E-4.1.1.1. A description of the Informational Lines is provided by the R&P Manual on Page 4-9. A cleaned size selective inlet (as per Appendix F of the R&P Manual) should also be installed at this time.

E-4.1.2.4 BIWEEKLY CHECK

Every two weeks, record the results of the total and main flow checks and the average pressure and temperature readings onto the monthly maintenance/Q.C. checksheet. The ambient pressure and temperature readings are variables used by the TEOM to calculate the mass concentration. They are accessed by scrolling down Menu Screen 12. These values should be the same as those measured with the technician's calibration temperature and pressure sensors.

The U.S. EPA recommends that a precision flow check be performed every two weeks. This is accomplished by measuring the main and total (sum of main and auxiliary) flowrates and comparing these measurements to the TEOM's indicated flowrates as shown on its digital display. Record these readings and measurements on the check sheet. If they differ by more than +/-5%, take corrective action and notify the supervisor. The flows may be measured with a Streamline FTS (flow transfer standard) or comparable device possessing an NIST-traceable certification.

NOTE: The TEOM flowrate display is in volumetric flow units (LPM). If the flow checks are measured with a MFM, standard liters per minute (SLPM) must be converted to LPM using the ambient pressure and temperature conditions present at the MFM. The equation for this conversion is as follows:

$$\text{LPM} = \frac{760\ \text{mmHg}}{\text{Pa mmHg}} \times \frac{\text{Ta} + 273°\text{C}}{298°\text{C}} \times \text{SLPM}$$

Where: Pa = Ambient Pressure in mmHg
Ta = Ambient Temperature in C

The procedure to perform the precision flowcheck is as follows:

1. Record the TEOM's digital display readings of the main and total (sum of main and auxiliary) flowrates.

2. Remove the PM10 inlet and install R&P flow adapter.

3. Measure and record the total flowrate.

4. Remove auxiliary flow line and cap at flow splitter.

5. Measure and record main flowrate.

6. Re-install auxiliary flow line and PM10 inlet.

7. Calculate and record the percent deviation of TEOM's indicated main flowrate from the measured flowrate using the following formula:

$$\% \text{ Deviation} = \frac{\text{indicated LPM}}{\text{Cal Device LPM}} \times 100$$

Where: Indicated = flowrate as indicated on TEOM's display
LPM = flowrate as measured by calibration device

E-4.1.2.5 QUARTERLY CHECKS

1. Conduct a complete flow rate check, including the main, auxiliary, and total flow rates.
2. Conduct a leak check.
3. Complete the TEOM Flow Check Form (Figure E-4.2.0.2)

NOTE: The leak check procedure to be followed is on Page 7-4 of the R&P Manual. In addition, perform the leak test after the "as-is" quarterly flow rate check.

E-4.1.2.6 SEMIANNUAL CHECK (Every six months)

1 Clean the Air Inlet System as per Page 7-3 of the R&P Manual.
2 Replace the main and auxiliary flow inline filters.
3 Perform a flow controller software calibration and leak test.

E-4.1.2.7 ANNUAL CHECK Once per year perform the following:

1 Analog input and output calibration
2 Flow controller hardware calibration
3 Mass transducer calibration verification

E-4.1.2.8 PERFORM AS REQUIRED

1 Disassemble and clean size selective inlet concurrently with replacement of TEOM microbalance (sample) filter.
2 Replace auxiliary flow filter(s).

Great Basin Unified Air Pollution Control District

STANDARD OPERATING PROCEDURES FOR AIR QUALITY MONITORING

APPENDIX E-4.2.0

CALIBRATION PROCEDURE FOR THE RUPPRECHT & PATASHNICK SERIES 1400a(AB) TEOM PM10 MONITOR

December 2012

E-4.2.0 CALIBRATION PROCEDURE

E-4.2.0.1 GENERAL INFORMATION
Calibration of the TEOM consists of several procedures which are described step by step in Section 8 of the R&P Manual. The manufacturer's procedures should be followed, except as noted in these procedures, and documented on the TEOM Quality Control Maintenance Check Sheet/Log (Figure E-4.1.1.1), the TEOM Analog and Mass Flow Controller Calibration Form (Figure E-4.2.0.1), and the TEOM Flow Check Form (Figure E-4.2.0.2). The frequency of calibrations and the required apparatus are summarized as follows:

PROCEDURE, FREQUENCY, APPARATUS

1. Flow Controller Software Calibration
   a. Every 6 Months, as needed
   b. Flow rate transfer standard
   c. Calibrated thermometer and barometer
   d. R&P Flow Adapter
   e. 10 feet of 3/16" I.D. silicone tubing
   f. R&P zero (particulate) filter
   g. TEOM Analog and Mass Flow Controller Calibration Form (Figure E-4.2.0.1)

2. Analog Calibration
   a. Annual, once per year
   b. 3-1/2 digit (input/output) multimeter
   c. 12" length jumper wire
   d. TEOM Analog and Mass Flow Controller Calibration Form (Figure E-4.2.0.1)

3. Flow Controller Hardware Calibration
   a. Annual, once per year
   b. Flow rate transfer standard
   c. Calibrated thermometer and barometer
   d. TEOM Analog and Mass Flow Controller Calibration Form (Figure E-4.2.0.1)

4. Mass Transducer Calibration Verification
   a. Annual, once per year
   b. R&P Calibration Verification Kit or District-certified preweighed sample filters
   c. TEOM Analog and Mass Flow Controller Calibration Form (Figure E-4.2.0.1)

E-4.2.0.2 FLOW CONTROLLER SOFTWARE CALIBRATION
This procedure consists of measuring the total, main, and auxiliary flowrates with a certified transfer standard and calculating the deviations from the inlet design and the TEOM's displayed and setpoint flowrates. These flowrate deviations may be corrected by adjusting the TEOM's FAdj (Flow Adjust) software settings for each flowrate, main and auxiliary, as previously mentioned in E-4.1.1.3. In

addition to the flow check, a leak test, a zero filter check, cleaning of the Air Inlet System per Page 7-4 of the R&P Manual, and replacement of filters, should also be performed at this time.

In R&P's procedure for the flow check (Section 8.2 of the R&P Manual), the flow measurements are taken at the rear of the control unit after the main and auxiliary online filters have been removed. This raises concerns because the sampling train is disconnected from the system. It is recommended that the flows be measured at the flow splitter inlet as described on Page 8-14 (Flow Audit Procedure) of the R&P Manual. This method is consistent with flow measurement methods employed by the District's QA audit procedures
.

The following is a summary of the software calibration procedure: Equations cited, (1), (2), etc., are from TEOM Analog and Mass Flow Controller Calibration Form (Figure E-4.2.0.1).

1. Disable or Flag the TEOM channel of data logger.

2. Record on TEOM Analog and Mass Flow Controller Calibration Form (Figure E-4.2.0.1) site and calibration standards information.

3. Using equation (1), calculate Temp/Press Correction Factor.

4. Record TEOM display readings onto the calibration datasheet, i.e., indicated flowrate displays and setpoints, average temperature, pressure and flow adjust settings.

5. Measure the total, main, and auxiliary flowrates (at the inlet) with a transfer standard per Page 8-1 of the R&P Manual.

6. Using equation (2) and (3), calculate and record the percent deviation of total flowrate from 16.67 LPM

NOTE: If the "as-is" deviation is found to be greater than +/-10.0%, invalidate affected mass concentration data and initiate an Air Quality Data Action (AQDA) request, if necessary. Volume II Section Z.2.0 Revision 0 January 23, 1995 Page 3 of 7

7. Using equation (4), calculate and record the percent deviation of the TEOM's main and auxiliary indicated (by display) flowrates from the transfer standard's flowrate (both in LPM).

NOTE: These "as is” main and auxiliary flowrate deviations will be proportional to the corrective "final" FLOW ADJ settings in step12 below.

8. Using equation (5), the TEOM's main flowrate setpoint and the Avg Press and Temp settings, calculate and record the TEOM's main flowrate in SLPM.

NOTE: The TEOM's mass concentration (in standard units) is calculated by the TEOM using the rate of mass accumulation and the main flowrate (in SLPM) which has been calculated by the TEOM using the main flowrate setpoint (in LPM) and the average pressure and temperature settings.

9. Using equation (6), calculate and record the percent deviation of the TEOM's calculated main flowrate from the transfer standard's flowrate (both in SLPM).

NOTE: If the "as-is" deviation is found to be greater than +/-10%, correct the affected data by the amount of deviation and initiate an AQDA if necessary. Also, perform both hardware and analog calibrations before proceeding with the "final" portion of the software calibration.

10. Separate the sample probe from the sensor housing and install a zero (particulate) filter onto the sensor probe. The TEOM's mass concentration display should read less than +/- 5.0 mg/m3 in 30 minutes or less. Record the results of the zero filter check after the 30-minute waiting period.

11. Remove the zero filter, re-attach the sample probe and perform a leak check per Page 7-4 of the R&P Manual. Record resultant TEOM flowrate displays.

12. Adjust the TEOM's main and auxiliary FLOW ADJ settings to correct for the flow deviations calculated in step 7 and any other setting changes such as average temperature.

13. Repeat flow measurements for final software calibration, perform a zero filter check, leak test, and record results.

14. Perform a precision flow check of the main and auxiliary flowrates using the operator's flow measuring device. Record these results onto the TEOM Quality Control – Maintenance Check Sheet/Log, Page 1 (Figure E-4.1.1.1).

15. Assure that the TEOM is back in normal operation then ReEnable or Unflag data logger channel.

16. Prepare the TEOM Flow Check Form (Figure E-4.2.0.2) and submit along with TEOM Analog and Mass Flow Controller Calibration Form (Figure E-4.2.0.1); originals to station file and copies to the TEOM operator within 30 days.

E-4.2.0.3 ANALOG CALIBRATION
This procedure consists of adjusting the analog input and output potentiometers on the TEOM's Analog Input/Output Board. Follow the directions written in Section 8.3 of the R&P Manual and record date of procedure onto the TEOM Analog and Mass Flow Controller Calibration Form (Figure E-4.2.0.1).

E-4.2.0.4 MASS FLOW CONTROLLER HARDWARE CONFIGURATION
R&P recommends that the analog calibration procedure be performed prior to the mass flowmeter hardware calibration. In addition, both of these calibrations should be performed on at

least an annual basis or if the "as is" flow deviation is found to be greater than +/- 10% during the flow controller software calibration. Refer to Section 8.4 of the R&P Manual for directions in performing the hardware calibration.

NOTE: The hardware calibration procedures set forth in the R&P Manual specify the use of a volumetric flow measuring device. This is because the flow indication shown on the TEOM's digital display is in LPM. If mass flowmeters (MFM) are used, it will be necessary to convert to LPM using the temperature and pressure conditions present at the MFM transfer standard. The equation for this conversion is in Section E-4.1.2.4 of these procedures. Record the date this procedure was last performed onto the TEOM Analog and Mass Flow Controller Calibration Form (Figure E-4.2.0.1).

E-4.2.0.5 MASS TRANSDUCER CALIBRATION

The results of the mass transducer calibration (verification) are used to indicate whether the calibration constant (Ko) of the mass transducer has significantly changed since the instrument left the factory. It is performed by using a certified weighed sample filter as supplied by R&P in the Calibration Verification Kit or an equivalent filter from the District's Gravimetric Laboratory. R&P recommends that if the indicated calibration constant differs by more than 2.5% from the original value, they should be contacted. It is recommended that this verification be performed every 2 years following the steps outlined in Section 8.5 of the R&P Manual. Record the date this procedure was last performed onto the TEOM Analog and Mass Flow Controller Calibration Form (Figure E-4.2.0.1).

Great Basin Unified Air Pollution Control District
TEOM
Analog and Mass Flow Controller Calibration

Site Name ____________ Date ____________
Site No. ____________ Technician ____________
Instrument No. ____________

DVM
Make / Model ____________
s/n ____________
Cal Date ____________

Flow Meter
Make / Model ____________

Range	S/N	Cal Date	Slope	Intercept

Jumpers

	0	1	2	3	4	5	6	7
Output								
Input 0-7								
Input 8-15								

Analog Output Set Pt = 90 %

	0	1	2	3	4	5	6	7
DVM as-is								
DVM final								

Analog Input Set Pt = 90%

	0	1	2	3	4	5	6	7
DVM as-is								
A/I as-is								
A/I final								
	8	9	10	11	12	13	14	15
DVM as-is								
A/I as-is								
A/I final								

Mass Fow Controller

	As-Is	Current	Final
Temp T/A			
Press P/A			

Main — limit =± 0.03 lpm

	TEOM Display		Flow std As-Is		Flow std Final	
Set Pt	As-Is	Final	P H2O	LPM	P H2O	LPM
0.5						
4.5						
3.0						

Auxillary — limit =± 0.2 lpm

	TEOM Display		Flow std As-Is		Flow std Final	
Set Pt	As-Is	Final	P H2O	LPM	P H2O	LPM
2.0						
18.0						
13.67						

Figure E-4.2.0.1 TEOM Analog and Mass Flow Controller Calibration Form

Great Basin Unified Air Pollution Control District

Tapered Element Oscillating Microbalance (TEOM) Flow Check

Date:			Site Name:				
Start:		PST	Site #:				
Finish:		PST	Operator:				
			Project:				
Make:	R&P		Site Elevation:		ft		
Model:	1400ab		Amb. Press.:		"Hg	/29.92=	atm.
Prop. # / Ser. #:	/		Amb. Temp.:		°C	+273=	°K
Type:	PM_{10}						
Last Cal. Date:							

Audit Device(s)

Make:	Chinook Eng.	Make:	Chinook Eng.
Model:	Streamline FTS	Model:	Streamline FTS
S/N:		S/N:	
Range:		Range:	
Calibration factors:		Calibration factors:	
Slope:		Slope:	
Int.:		Int.:	
Cal Date:		Cal Date:	

$Q_a = m[dPxT_a/P_a]^{1/2} + b$

Flow Check	Audit Flow		Ind. Flow	Diff. *	Nominal Flow Limit †	
	delta P	(VLPM)	(VLPM)	(%)	(LPM)	(LPM)
Total Flow Rate					15.7	17.7
Aux. Flow Rate						
Main Flow Rate					2.8	3.2

** Ind. Flow < 4% difference from verification flow*
† Verification flow < 6% difference from design flow

Leak Check	lpm	Limit, Over Dark Current
Main		< 0.15
Aux		< 0.65
Dark Current Main		
Dark Current Aux		

(Perform final leak check only)

Verify	Sampler		Standard		(Raw)	Diff.
Amb Temp		°C		°C		
Amb Press		atm		atm		
Time		PST		PST		

Comments:

NOTE: Indicated and Verification flow measurement criteria are established as warning levels only.
Validity of data is dependent upon meeting the criteria of ≤ 10% difference from design flow.
Exceeding indicated flow measurement criteria of ≤ 6% necessitates a software calibration of the flow meter(s).

Calibrated by: Reviewed by:

TEOM Quarterly Verification Form 2.0 - 5/2001

Figure E-4.2.0.2 TEOM Flow Check Form

GREAT BASIN UNIFIED
AIR POLLUTION CONTROL DISTRICT

AIR MONITORING QUALITY ASSURANCE

PM 10 QAPP

APPENDIX E-5

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

RUPPRECHT & PATASHNICK
PARTISOL MODEL 2000 PM10 AIR SAMPLER

DECEMBER 2012

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RUPPRECHT & PATASHNICK
PARTISOL MODEL 2000 PM-10 AIR SAMPLER

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APPENDIX E-5

RUPPRECHT & PATASHNICK PARTISOL MODEL 2000 PM-10 AIR SAMPLER

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APPENDIX E-5

RUPPRECHT & PATASHNICK
PARTISOL MODEL 2000 PM-10 AIR SAMPLER

FIGURES

E-5.1.0 GENERAL INFORMATION

E-5.1.0.1 Purpose

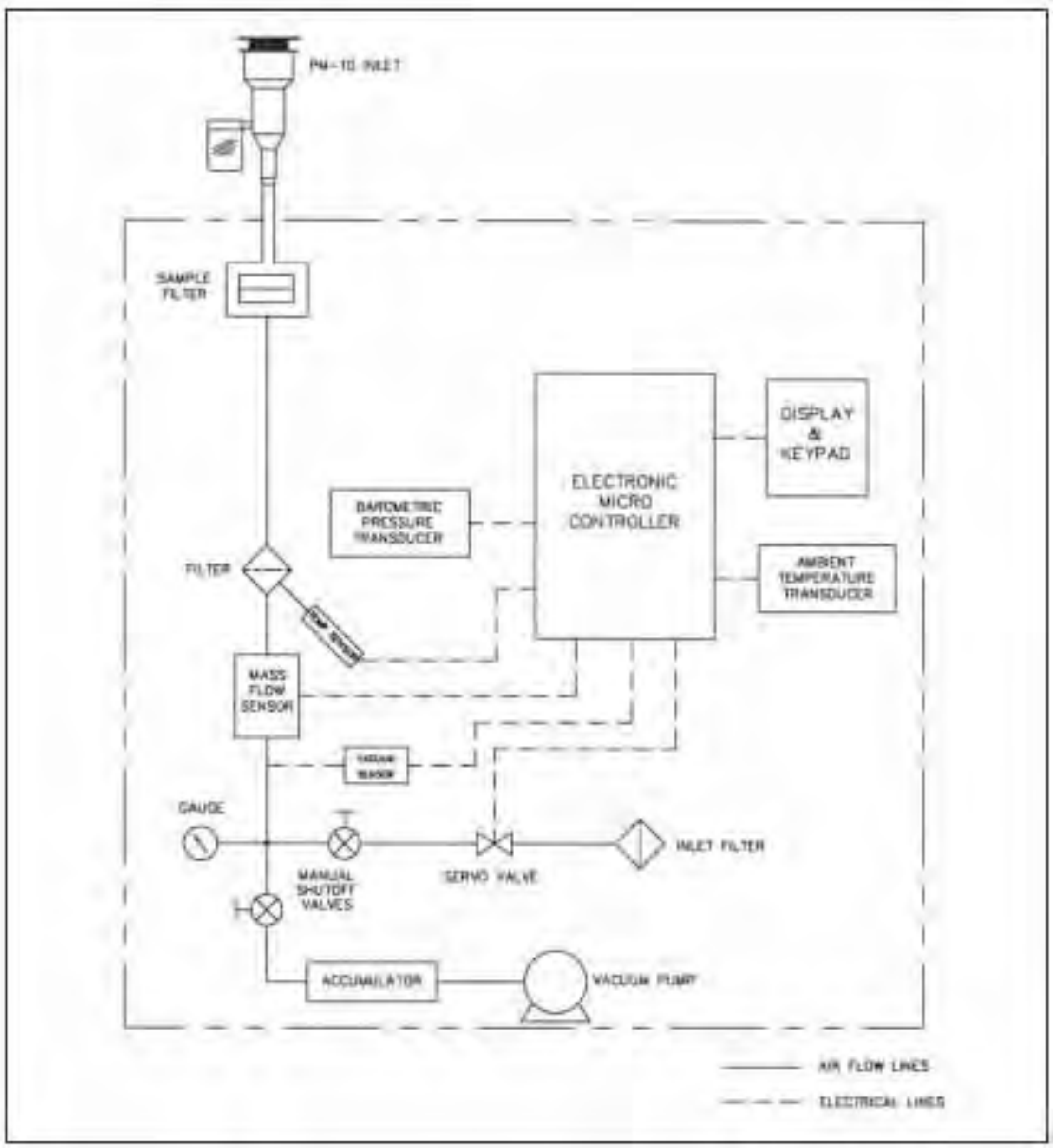
The purpose of these Standard Operating Procedures (SOP) is to supplement the manufacturer's Operator's Manual by describing modifications in hardware or procedures which may have been implemented by the Monitoring and Laboratory Division of the Air Resources Board. These modifications are designed to assure compliance with the Federal Reference Method for collection of particulate matter 10 microns or smaller (PM10) when using the Rupprecht & Patashnick (R&P) Partisol-Plus Model 2000 PM10 Air Sampler.

E-5.1.0.2 General Description and Theory of Operation

Read Section 1 of the R&P Operating Manual and see Figure E-5.1.0.2 Partisol 2000 Schematic.

E-5.1.0.3 Safety

Installation, operation, maintenance, or calibration of the sampler should only be performed by properly trained personnel. High (120 volts A.C.) voltages are used to power the unit and due to typical rooftop installations, the risks of working outdoors at elevation should also be considered.



E-5.1.0.2 Partisol 2000 Schematic

E-5.1.1 INSTALLATION PROCEDURE

E-5.1.1.1 Physical Inspection

Each R&P Partisol-FRM Model 2000 PM10 Air Sampler by the District should be supplied with the following items:

1 Partisol-Plus enclosure with filter exchange mechanism
1 Inlet system for size-selective sampling
1 sample tube
1 Partisol-Plus stand
3 rain hoods and associated hardware
1 flow audit adapter
3 magazine transport container with cassettes and carriers
1 ambient temperature sensor and cable
3 filter cassette magazines
2 sets of inlet O-rings
1 analog input calibration cable
1 mating cable connector for four-pin user output connector
1 Operating software diskette
1 9-to-9 pin computer cable
2 Operating Manuals
1 Service Manual
1 Quick Start Guide

Upon receipt of the sampler(s), inspect sampler and accessories for shortage and for shipping damage. If shortage or damage is found, immediately notify your supervisor, and/or your agency's shipping department.

E-5.1.1.2 Initial Sampler Installation

Follow directions found in Section 2 of the R&P Operating Manual for installation instructions and consult with your area specialist/engineer or supervisor to assure that installation site complies with Federal and State siting criteria for FRM PM10.

E-5.1.1.3 Initial Sampler Set-Up

Follow directions found in Sections 4, 5, and 6 of the R&P Operating Manual.

E-5.1.2 ROUTINE SERVICE CHECKS

E-5.1.2.1 General Information
Monthly Quality Control Maintenance Check Sheet, Figure E-5.1.2.1.1

E-5.1.2.2 Daily Checks
• Status 'OK'
• Check time, date, & start time
• Mode 'Wait', 'Samp', or 'Done' depending on sampling condition

E-5.1.2.3 Weekly Checks
• Inspect cassette seals & clean as needed
• Sample run times & flows OK

E-5.1.2.4 Monthly Checks
• Clean or exchange PM10 inlet & water trap
• Inspect V seals and clean as needed.
• Clean sampler case
• Clean downtube
• Inspect & service air intake fans & filters
• Perform sampling verification tests – Flow rate, temperature, pressure, leak checks
• Download filter data

E-5.1.2.5 Quarterly Checks
• Inspect & service downtube & case seals
• Inspect & service pump and tubing connections
• Inspect & service electrical components & connections
• QA performance audit conducted by District auditor

E-5.1.2.6 Semiannual Checks
• Clean & service air intake fans & filters
• Test batteries – Lithium 'button' and chip on main board
• Perform pump test

E-5.1.2.7 Annual Checks
• Replace O-rings & V-seals
• Perform instrument calibrations
  - Interface board
  - Analog inputs
  - Pressure sensor
  - Ambient temperature sensor – 3 pt.
  - Filter temperature sensor – 3 pt.
  - Flow rate – 3 pt.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

Quality Control - Maintenance Check Sheet / Log

PARTISOL FRM 2000 – PM_{10}

Station Name: ______________________ Month / Year: ______________________

Station Number: ______________________ Technician: ______________________

Property Number: ______________________ Serial Number: ______________________

Site Elevation: ______________________

Last Cal. Date: ______________ Last Cal. Flow / △% : ______________________

EACH FILTER EXCHANGE	Date	Date	Date	Date	Date
Inspect upper & lower cassette seals. Clean as necessary.					

MONTHLY (or as necessary)	Inlet #/Date	Inlet #/Date	Inlet #/Date	Inlet #/Date	Inlet #/Date
Clean (C) or exchange (X) PM_{10} inlet & trap. Inspect O-rings.					

MONTHLY	Date/Time
Sampling Verification Tests: Temperatures (1 pt), Pressure, Internal Leak Check, External Leak Check, Flow Rate (1 pt), Clock	
Inspect/Clean V-Seals: Replace if necessary	
Clean interior of sampler case	
Clean downtube	
Inspect & service cooling air intake filter & fans	
Download filter data	

QUARTERLY	Date/Time
Inspect & service water seal gasket where downtube enters case	
Inspect/service vacuum tube fittings, pump connections, electrical components	
QA: Sampler performance audits* [Temps, pressure, flow rate, leak check] *Criteria: Temperature ±2°C / Pressure ±10mm Hg / Flow Rate ±4% Warning; ±10% Invalidation or Correction	

Partisol FRM 2000 Maintenance 2.0
01/15/02 – PM10
Page 1 of 2 (sno)

Figure E-5.1.2.1.1 Monthly Quality Control Maintenance Check Sheet, Page 1

6 MONTHS	Date/Time
Replace large in-line filter	
Rainhoods: Clean air screens	
Test batteries on main computer board & in electronics compartment (2.5 VDC min.) Disk ________________VDC U4 __________________VDC	
Conduct pump test: Vac _____________"Hg	

ANNUALLY	Date/Time
Replace O-Ring (inlet) & V-Seals (inspected monthly)	
Calibration:	
• Interface board calibration	
• Analog input calibration	
• Ambient temperature multipoint verification	
• Ambient filter temperature multipoint verification	
• Pressure multipoint calibration	
• Flow rate multipoint calibration	

24 Months	Date/Time
Rebuild or replace pump (Test every 6 months)	

WHEN OUT OF SPECIFICATIONS (Otherwise at installation & annually)	Date/Time
Ambient temperature multipoint verification and/or calibration	
Filter temperature multipoint verification and/or calibration	
Pressure calibration	
Flow rate multipoint verification and/or calibration	

Comments:
____
____
____
____
____
____

Reviewed By: ______________________________ Date: ________________

Partisol FRM 2000 Maintenance 2.0
01/15/02 – PM10
Page 2 of 2 (sno)

Figure E-5.1.2.1.1 Monthly Quality Control Maintenance Check Sheet, Page 2

E-5.1.3 MAINTENANCE PROCEDURES

E-5.1.3.1 General Information
Read the operator's manual for more detailed information regarding sampler maintenance.

E-5.1.3.2 Sampler Maintenance
The sampler should be wiped down with a clean wet cloth when required. Clean the filter compartment with a wet cloth when required. Clean the sampler downtube as necessary; quarterly at minimum. Check "V" seals and replace when necessary. See operator's manual, section 3.1.5. "Inspect V Seals" for more information.

E-5.1.3.3 PM10 Inlet Maintenance
Clean the PM10 inlet as necessary: weekly for Owens Lake network sites; monthly at all other sites, at a minimum. Refer to section G.1. in the operators manual for specific instructions.

E-5.1.4 SAMPLE FILTER HANDLING PROCEDURES

E-5.1.4.1 General Information

Federal regulations stipulate specific time frames and environmental conditions for FRM PM10 sample filters at various stages in the sampling program. If these time frames and conditions are not met, sample filters may be flagged or invalidated by the receiving laboratory. In addition to these requirements, operators should practice the usual care to prevent or minimize contamination of the sample filters, filter cassettes, or anything else which may come in contact with the sample filters.

E-5.1.4.2 Presampling Filter Handling Procedures

Sample filters must be retained in their shipping containers prior to sampling to ensure that any possible contamination is prevented.

E-5.1.4.3 Postsampling Filter Handling Procedures

Sampled filters must be removed from the sampler and placed in their respective transport holders until they are transported to the laboratory. Sampled filters will be transported to the laboratory biweekly.

E-5.1.4.4 Filter Blank Handling Procedures

Upon receipt and identification of filter blanks, treat these filters the same as filters to be sampled with the exception that they will not be used to collect samples. They are to be installed in the sampler, the same as a filter sample, removed, stored in a transport container, and returned to the laboratory with the sampled filters. Fill out the GBUAPCD 24-Hour Sample Report-Field Data Sheet (Figure E-5.1.4.3.1) with exception of run data and submit with rest of Sample Reports.

E-5.1.5 TROUBLESHOOTING

E-5.1.5.1 General Information

If review of the R&P Operating Manual does not result in correction of the problem, notify your area engineer, specialist, and/or repair facility technician.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT
PARTISOL PM-10 24-HOUR SAMPLE REPORT AND CHAIN-OF-CUSTODY

Filter ID: ______________
Site Name: ______________ Cassette ID: ______________
Site ID: ______________ Run Date: ______________
Sampler ID: ______________ Transport to Field: ______________ / ______________
Initial Date

PRE-SAMPLE INFORMATION

Operator: ______________ Filter Install Date: ______________
Install Time: ______________

Stat (upper left): ______________ Mode (upper right): ______________
Start Date: ______________ Amb Temp: ______________
Sample Start: ______________ Filt Temp: ______________
Stop Date: ______________ Amb Press: ______________
Sample Stop: ______________

POST-SAMPLE INFORMATION

Operator: ______________ Filter Remove Date: ______________
Remove Time: ______________

Stat (upper left): ______________ Rec (upper right): ______________
Set Start: ______________

	Min	Avg	Max
Amb Temp:			
Filt Temp:			
Press:			

Act Start: ______________
Act Stop: ______________
Elapse Time: ______________
Max Temp Diff: ______________ Avg Flow: ______________ CV%: ______________
Max Temp Date/Time: ______________ / ______________ Total Vol: ______________

Oprtr Comments: ______________

Transport from Field: ______________ / ______________
Initial Date

LABORATORY INFORMATION

	Weight	Duplicate	Date	Analyst
Initial:				
Final:				

Comments: ______________

Figure E-5.1.4.3.1 GBUAPCD 24-Hour Sample Report-Field Data Sheet

GREAT BASIN UNIFIED
AIR POLLUTION CONTROL DISTRICT

AIR MONITORING QUALITY ASSURANCE

APPENDIX E-5.2

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

CALIBRATION PROCEDURES FOR R&P PARTISOL MODEL 2000 PM10 AIR SAMPLER

DECEMBER 2012

E-5.2.0 BACKGROUND AND GENERAL INFORMATION

E-5.2.0.1 Introduction

This SOP for the Rupprecht & Patashnick Partisol Model 2000 PM10 Air Sampler (R&P PM10 FRM) is written as a starting point only. The procedures listed are in reference to the R&P Operating Manual and are constantly being revised and updated. This document is current as of its date and will likely change as the monitoring program continues.

E-5.2.0.2 Overview

The calibration of the particulate matter samplers whose mass has an aerometric diameter of less than 10 microns (PM10) must be performed on an annual basis. There are several parameters that must be calibrated with this new generation of fine particulate matter samplers. These parameters include flow or volume, temperature, pressure and time. The GBUAPCD has chosen three reference method samplers to monitor for PM10 at this time. These samplers are the BGI PQ200 Air Sampler, the R&P Partisol-Plus 2025 sequential sampler and the R&P Partisol FRM 2000 sampler. Each sampler has a different principle of flow and, therefore, two calibrations are required for this SOP. The following procedures concentrate on the R&P PM10 FRM 2000.

The calibration procedure in Section 12 of the R&P Operating Manual is fairly complete, accurate and easy to follow. The primary purpose of the calibration is to determine and/or verify that the volumetric flow of the PM10 sampler is at 16.67 liters per minute (LPM), or that the sampler collects a volume of 1 cubic meter of air per hour. Refer to 40 CFR Part 50, Appendices J and M for further information.

E-5.2.0.3 Apparatus for R&P PM10 Sampler Calibration

1. NIST-traceable mass flow transfer standard
2. NIST-traceable temperature sensor
3. NIST-traceable pressure sensor
4. R&P inlet flow adaptor
5. tubing
6. blank filter
7. calibration forms or laptop computer
8. Leak check disk

E-5.2.0.4 General Information

The calibration of the R&P PM10 FRM sampler should be performed in the following steps:

1) temperature calibration
2) pressure calibration
3) leak test
4) flow calibration
5) verify calibration parameters

All calibration information and data will be recorded on the Partisol Flow Check Data Sheet (Figure E-5.2.0.4.1).

Great Basin Unified Air Pollution Control District

Partisol Flow Check

Date:			Site Name:				
Start:		PST	Site #:				
Finish:		PST	Operator:				
			Project:				
Make:	R&P		Site Elevation:		ft		
Model:	2000 / 2025	*(circle one)*	Amb. Press.:		"Hg	/29.92=	Atm
Prop. # / Ser. #:	/		Amb. Temp.:		°C	+273=	°K
Type:	PM_{10} / $PM_{2.5}$	*(circle one)*					
Last Cal. Date:							

	Audit Device
Make:	Chinook Eng.
Model:	Streamline FTS
S/N:	
Range:	
Calibration factors:	
m:	
b:	
Cal date:	

$Q_s=m[dPxT_s/P_s]^{1/2}+b$

Verify	Sampler		Standard		(Raw)	Diff.
Filter Temp		°C		°C		
Amb Temp		°C		°C		
Amb Press		mm		mm		
Date						
Time		PST		PST		

Leak Check	Initial Pres.	Final Pres.	P_i-P_f	$Limit_{2025}$	$Limit_{2000}$
External				<25mm	<17"/min
Internal				<140mm	<17"/min

Flow Check	Audit Flow		Ind. Flow	Diff. *	Nominal Flow Limit †	
	delta P	(VLPM)	(VLPM)	(%)	(LPM)	(LPM)
Total Fow Rate					15.9	17.5

For PM2.5 : ** Ind. Flow < 4% difference from verification flow*
† Audit flow < 5% difference from design flow (16.7 lpm)

For PM10 : ** Ind. Flow < 7% difference from verification flow*
† Audit flow < 10% difference from design flow (16.7 lpm)

Comments:

Calibrated by: Reviewed by:

Partisol Monthly Verification Form 2.0 - 5/2001

Figure E-5.2.0.4.1 Partisol Flow Check Monthly Verification Form

E-5.2.1 CALIBRATIONS

E-5.2.1.1 Temperature Sensor Calibration

The R&P PM10 Partisol-Plus sequential sampler has two temperature sensors: the ambient and the filter sensors. These two temperature sensors require one temperature data point each to calibrate. To calibrate, the following procedure requires an external calibrated thermometer or other calibrated temperature reading device.

E-5.2.1.1.1 Ambient Sensor

Return the sampler to the "Main Screen." The device must be in the "Stop Operating Mode" to perform an ambient temperature sensor calibration.

1. Press <Menu> to enter the service menu with the cursor point to "Calibration/Audit."
2. Press <F3:Senscal> to enter the sensor caliberation screen.
3. Determine the current temperature in ^{O}C at the ambient temperature sensor using the external thermometer.
4. Press <Edit> to enter the edit mode, and move the cursor to the "ACT" (actual) column in the row labeled "AmbT."
5. Enter the current temperature in ^{O}C and press <ENTER> to leave the edit mode.
6. Upon receiving the actual temperature, the system's microprocessor automatically computes the span for the ambient temperature sensor. Note this number for future reference.

E-5.2.1.1.2 Filter Sensor (Service Manual Section 3.2.4)

Return the sampler to the "Main Screen." The device must be in the "Stop Operating Mode" to perform a filter temperature sensor calibration.

1. Press <Menu> to enter the service menu. With the cursor pointing to "Calibration/Audit," press <F4:FiltCal> to enter the filter temperature calibration screen.
2. Determine the current temperature in ^{O}C at the location of the sample filter in the FRM using the external thermometer.
3. Press <Edit> to enter the edit mode, and move the cursor to the "ACT" (actual) column in the row labeled "FltT."
4. Enter the current temperature in ^{O}C and press <ENTER> to leave the edit mode.
5. Upon receiving the actual temperature, the system's microprocessor computes the span for the filter temperature sensor. Note this number for future reference.

E-5.2.1.2 Barometric Pressure Sensor Calibration (Service Manual Section 3.2.5)

Return the sampler to the “Main Screen.” The device must be in the “Stop Operating Mode” to perform a barometric pressure sensor calibration.

1. Press <Menu> to enter the service menu. With the cursor pointing to “Calibration/Audit,” press <F3:SensCal> to enter the sensor calibration screen.
2. Determine the current ambient barometric pressure in mm Hg.
3. Press <Edit> to enter the edit mode, and move the cursor to the “ACT” (actual) column in the row labeled “Pres.”
4. Enter the current pressure in mm Hg and press <ENTER> to leave the edit mode.
5. Upon receiving the actual pressure, the system’s microprocessor computes the span for the ambient pressure sensor. Note this number for future reference.

E-5.2.1.3 Flow Rate Calibration

E-5.2.1.3.1 Leak Check

Before calibrating the flow of the sampler it is important to ensure that the sampling train does not have a leak. The leak check should be performed as described in Sections 12.1, 12.1.5, and 12.1.7 of the R&P Operating Manual.

E-5.2.1.3.2 Flow Rate Calibration (Service Manual Section 3.2.8)

The flow rate of the R&P PM10 FRM sampler must be 16.67 LPM in order to correctly select particulate matter smaller than 10 microns in diameter. The purpose of the flow rate calibration is to ensure that the sampler draws the correct volumetric air flow rate. Section 11.6 of the R&P PM10 FRM Operating Manual discusses the sampler flow calibration. The R&P PM10 FRM sampler is flow rate calibrated by testing the flow rate at 3 points using a NIST-traceable Streamline FTS Flow Transfer Standard. Return the sampler to the “Main Screen.” The device must be in the “Stop Operating Mode” to perform a barometric pressure sensor calibration.

1. Carefully remove the 1st stage inlet from the sampler.
2. Display the “Flow Calibration Screen” by pressing <F5: Setup>, <F2: Calib> and <F2:FlowCal> when in the Main Screen.
3. Five points will be determined and entered. The sampler will compute the proper value for flow span.

E-5.2.2 SAMPLER CALIBRATION VERIFICATION

E-5.2.2.1 Temperature Sensor Verification

The R&P PM10 Partisol sampler has two temperature sensors: the ambient and the filter sensors. These two temperature sensors require one temperature data point each to calibrate and each sensor requires only one point to verify. To verify the calibration, the following procedure requires an external calibrated thermometer or other calibrated temperature sensor.

E-5.2.2.1.1 Ambient Temperature Sensor (Operator's Manual Section 12.1.1)

1. Install an audit magazine (containing an empty cassette with no screen in the top position, an external leak check cassette containing a filter in the second position, and an internal leak check cassette containing a solid disk in place of the filter in the third position) into the left or supply side of the sampler. Place an empty magazine on the right or exit side of the sampler.
2. Press <Menu> to display the master menu. Scroll down to "Service Mode," and press <ENTER>
3. Press <F1:Audit> to display the audit screen.
4. Determine the current temperature in ^{O}C at the ambient temperature sensor using the external thermometer.
5. Verify that the value for the temperature displayed as "Ambient Temp" in the Audit Screen is within +/-2 ^{O}C of the external thermometer.
6. If the ambient temperature sensor reading is not within +/-2 ^{O}C of the external thermometer, the ambient temperature sensor must be re-calibrated.

E-5.2.2.1.2 Filter Temperature Sensor (Operator's Manual Section 12.1.2)

1. Install an audit magazine (containing an empty cassette with no screen in the top position, an external leak check cassette containing a filter in the second position, and an internal leak check cassette containing a solid disk in place of the filter in the third position) into the left or supply side of the sampler. Place an empty magazine on the right or exit side of the sampler.
2. Press <Menu> to display the master menu. Scroll to "Service Mode," press <ENTER>
3. Press <F1:Audit> to display the audit screen.
4. Press <F4: Filter Advance> to advance the empty cassette into the sampling position. This allows the calibration thermometer to be placed near the filter temperature probe.
5. Determine the current temperature in ^{O}C at the location of the sample filter in the FRM using the external thermometer.
6. Verify that the value for the temperature displayed as "Filter Temp" in the Audit Screen is within +/-2 ^{O}C of the external thermometer.
7. If the filter temperature sensor reading is not within +/-2 ^{O}C of the external thermometer, the filter temperature sensor must be re-calibrated.

E-5.2.2.2 Barometric Pressure Verification (Operators Manual Section 12.1.3)

1. Install an audit magazine (containing an empty cassette with no screen in the top position, an external leak check cassette containing a filter in the second position, and an internal leak check cassette containing a solid disk in place of the filter in the third position) into the left or supply side of the sampler. Place an empty magazine on the right or exit side of the sampler.
2. Press <Menu> to display the master menu. Scroll down to "Service Mode," and press <ENTER>
3. Press <F1:Audit> to display the audit screen.
4. Determine the current ambient barometric pressure in mm Hg.
5. Verify that the value for the "Ambient Pres" in the Audit Screen is within 10 mmHg of the measured ambient pressure.
4. If the sampler ambient pressure is not within 10 mmHg of the measured ambient pressure, the barometric pressure sensor must be re-calibrated.

E-5.2.2.3 External Leak Check (Operators Manual Section 12.1.5)

1. Install an audit magazine (containing an empty cassette with no screen in the top position, an external leak check cassette containing a filter in the second position, and an internal leak check cassette containing a solid disk in place of the filter in the third position) into the left or supply side of the sampler. Place an empty magazine on the right or exit side of the sampler.
2. Press <Menu> to display the master menu. Scroll down to "Service Mode," and press <ENTER>
3. Press <F1:Audit> to display the audit screen.
4. Attach the flow audit adapter to the sample tube and close the valve on the flow audit adapter.
5. Press <F5:Leak Check> to display the Leak Check screen. Press <F2:Start>, and follow the instructions displayed on the screen.
6. A "Pass," or "Fail," message will appear on the display. If the "Fail," message appears, conduct a second leak check with a different filter. If the sampler fails again, follow the troubleshooting guide in the manual. If the "Pass," message appears, slowly open the valve on the flow adapter.

E-5.2.2.4 Flow Rate Verification (Operators Manual Section 12.1.6)

1. Install an audit magazine (containing an empty cassette with no screen in the top position, an external leak check cassette containing a filter in the second position, and an internal leak check cassette containing a solid disk in place of the filter in the third position) into the left or supply side of the sampler. Place an empty magazine on the right or exit side of the sampler.
2. Press <Menu> to display the master menu. Scroll down to "Service Mode," and press <ENTER>
3. Press <F1:Audit> to display the audit screen.
4. Carefully remove the 1st stage inlet from the sampler.
5. Attach the flow rate verification device to the sampler.
6. Turn on the pump by pressing <F2: Pump>, and then turn on the sample flow valve by pressing <F1: Valve>.

7. Determine the flow in units of actual (volumetric) LPM using the flow rate verification device.
8. Verify that the value for the flow rate displayed in the “Flow Rate” field of the Audit Screen is within +/-4% of the flow rate verification device.
9. If the flow rate reading is not within +/-4% of the flow rate verification device, a flow rate calibration must be performed.

E-5.2.2.5 Internal Leak Check

1. Install an audit magazine (containing an empty cassette with no screen in the top position, an external leak check cassette containing a filter in the second position, and an internal leak check cassette containing a solid disk in place of the filter in the third position) into the left or supply side of the sampler. Place an empty magazine on the right or exit side of the sampler.
2. Press <Menu> to display the master menu. Scroll down to “Service Mode,” and press <ENTER>
3. Press <F1:Audit> to display the audit screen.
4. Press <F4:Filter Advance> to move the cassette with the leak check disk into the sampling position. Press <F5:Leak Check> to display the leak check screen.
5. Press <F2:Start>, and follow the instructions displayed on the screen.
6. The Partisol-Plus will run an automatic leak check. A “Pass,” or “Fail,” message will appear on the display.
7. Press <F4:FiltAdv> to move the leak check cassette to the storage magazine. If the “Fail,” message appears, clean the cassette and leak check disk carefully, examining the disk for any scratches or nicks. Rerun the test with an undamaged leak check disk. If the sampler fails again, follow the troubleshooting guide in the manual.
8. If the “Pass,” message appears, the internal leak check is complete. Remove the audit magazine from the supply side of the sampler and set up for normal sampling operations.

E-5.2.2.6 Clock/Timer Verification

Units of time are used in several aspects of sampler operation. Examples are the start and stop times, volume/flow calculations, run dates, etc. Therefore, it is necessary to document the time setting of the sampler.

Observe the sampler time from the Main Screen. Enter this value onto the calibration data sheet. At the same time, enter the value of your time keeping device. Identify your time keeping device on the calibration data sheet. Include the make, model, ID number, date last certified, and bias of your clock.

If the sampler is greater than 12 minutes from true time, reset the system clock.

To reset the clock, from the Main Screen select <F5: Setup>, then select <F1: Edit>. Enter the correct time to +/- 1 minute from true. Enter the corrected time on your calibration data sheet.